ABSTRACTS OF NORTH AMERICAN GEOLOGY

August 1966

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1966

UNITED STATES DEPARTMENT OF THE INTERIOR

STEWART L. UDALL, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402. Price 45 cents (single copy). Subscription price: $5.00 a year (12 monthly issues); $1.25 additional for foreign mailing. Use of funds for printing this publication approved by the Director of the Bureau of the Budget (December 8, 1965).

(exp. 12-68)

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INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with limited circulations (such as dissertations, open-file reports, or memorandums) or of other papers presented orally at meetings.

The Abstracts will be an additional reference tool but will not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology will be published each year. The Bibliography will include citations and subject index for a calendar year.

Abstracts of North American Geology and the Bibliography are being prepared by use of computer techniques. Each abstract along with its indexing is placed on magnetic tape and entered into a permanent data bank. The material prepared each month will be published in the form of the present issue. The abstracts are arranged alphabetically according to senior author. A subject index follows the abstracts and is designed for rapid reference to any subject desired. Bibliographies can subsequently be retrieved according to the terms used in the index.

The abstracts in this issue were prepared by Georgianna D. Conant, H. R. Cornwall, W. C. Culbertson, A. A. Drake, S. E. Frezon, R. E. Grant, Andrew Griscom, B. C. Hearn, J. J. Hemley, J. W. Hosterman, P. B. Hostetler, C. B. Hunt, Virginia M. Jussen, B. H. Kent, A. R. Kinkel, E. R. Landis, E. H. Lathram, Marie L. Lindberg, Elisabeth S. Loud, E. K. Maughan, Mildred C. Mead, Virginia S. Neuschel, L. L. Ray, A. E. Roberts, E. H. Roseboom, C. A. Sandberg, S. P. Schweinfurth, J. G. Vedder, Dorothy B. Vitaliano, H. C. Wagner, F. C. Whitmore, Jr., E. W. Wolfe, and E-an Zen.

ABSTRACTS

Adams, J. A. S. *See* Horn, M. K. 4062

3939 **Adshead, Patricia C.** Observations on living planktonic Foraminifera in cultures [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 603–604, 1966.

4098 **Adshead, Patricia C.** Taxonomic significance of pseudopodial development in living planktonic Foraminiferida [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 642–643, 1966.

Agogino, G. A. *See* Denson, N. M. 3916

Albee, Howard F. *See* Staatz, Mortimer H. 4041

4099 **Allen, D. R.; Stockton, Douglas.** Injection water sources, Wilmington and east Wilmington oil fields [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 643, 1966.

Allen, L. S. *See* Tittle, C. W. 4235

4327 **Allen, Walter C.** An X-ray method for defining composition of a magnesium spinel: Am. Mineralogist, v. 51, nos. 1–2, p. 239–243, illus., 1966.

Lines of constant cell edge, refractive index and calculated density in the system $MgAl_2O_4$–$MgCr_2O_4$–$MgFe_2O_4$ intersect at too low angles to use for determining composition. However the ratio [intensity of (220)/intensity of (111)] crosses the others at a high angle. The method is limited to the above system.—E.H.R.

Allison, Edwin C. *See* Gastil, Gordon. 4072

Anders, Edward. *See* Heymann, Dieter. 3998

3999 **Anders, Edward; Lipschutz, Michael E.** Critique of paper by N. L. Carter and G. C. Kennedy [1964], "Origin of diamonds in the Canyon Diablo and Novo Urei meteorites": Jour. Geophys. Research, v. 71, no. 2, p. 643–661, illus., tables, 1966.

Carter and Kennedy (ibid., v. 69, p. 2403–2421, 1964) have claimed that diamonds in meteorites were formed by normal static processes. It is shown that their key exhibit, an "unheated" diamond-bearing Canyon Diablo specimen, contains ample evidence of shock in the range of 400–750 kb. A number of clarifications and corrections are offered. It is suggested that the diamonds were produced from graphite in the deeper and more highly shocked parts of a meteoroid.—D.B.V.

4001 **Anders, Edward; Lipschutz, Michael E.** Reply [to N. L. Carter and G. C. Kennedy's reply, 1966, to critique of "Origin of diamonds in the Canyon Diablo and Novo Urei meteorites"]: Jour. Geophys. Research, v. 71, no. 2, p. 673–674, table, 1966.

Criticisms by Carter and Kennedy (ibid., p. 663–672) dealing with information quoted from Heymann, Lipschutz, Nielsen, and Anders (ibid., p. 619–641) are rebutted here. The pressure scale, pressure gradients, and the spatial distribution and shock intensity of diamond-bearing meteorites are considered. An authentic

summary of Nininger's 1963 data is presented, which shows that the crucial correlation between diamonds and shock effects still holds.—D.B.V.

4188 **Anderson, Don L.** Recent evidence concerning the structure and composition of the Earth's mantle, *in* Physics and chemistry of the Earth, V. 6: New York, Pergamon Press, p. 1–131, illus., tables, 1965.

Modern methods of data analysis in conjunction with high-speed digital computers have made it possible to investigate mantle structure by precise determination of surface-wave dispersion. This paper summarizes and reexamines current information and speculation on properties of the mantle, and indicates potential areas for research and the nature of discrepancies and limitations in present knowledge to be resolved by the surface-wave method. The five sections include an introduction and summaries of available body-wave results pertaining to the upper mantle; of information on density, temperature, and composition of the Earth's interior as determined from seismic wave velocities; of the theoretical basis for calculating dispersion in a multilayered medium; and of results of analyses of dispersion and determinations of deep mantle structure from long-period wave and free oscillation data.—V.S.N.

Anderson, R. E. *See* Lipman, P. W. 4271

3940 **Anderson, Richard E.** The computer and the subsurface geologist [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 604, 1966.

Antoine, John. *See* Ewing, Maurice. 3898

Armstrong, Richard L. *See* Pierce, Kenneth L. 3930

Atherton, Elwood. *See* Swann, David H. 4058

4276 **Baer, A. J.; Hutchison, W. W.; Souther, J. G.** Geology, Bella Coola, British Columbia: Canada Geol. Survey Prelim. Ser. Map 7–1965, scale 1:253,440, text, 1966.

Bedrock in the Bella Coola area is commonly well exposed, except in creek and valley bottoms and in the northeastern part where glacial drift is widespread. The oldest plutonic rock is a greenish granodiorite. Descriptions of Mesozoic and Cenozoic rocks are related to the mapped units. Although small moraines surround present glaciers, most deposits of an earlier glaciation have been washed away or have lost their morphological characteristics; striae indicate that glaciers covered the country to an approximate elevation of 7,500 feet. Though prospecting has been intermittent and unrewarding, mineral occurrences have been known for many years in the area.—M.C.M.

4249 **Baker, Claud H., Jr.** Geology and ground water resources of Richland County—Pt. 2, Basic data: North Dakota Water Conserv. Comm. County Ground Water Study 7 (North Dakota Geol. Survey Bull. 46), 170 p., illus., tables, 1966.

The ground-water basic data for Richland County, N. Dak., is intended to make available to the public the information needed to facilitate water-supply developments and to supplement the reports on geology and ground-water resources of the County, which will be published later. Tabulated are records of wells, springs, and test holes; water levels in selected observation wells; chemical analysis of water from selected wells; and logs of test holes.—M.C.M.

Baker, R. C. *See* Godby, E. A. 3906

Ballman, A. A. *See* Wood, D. L. 4322

3941 **Bandy, Orville L.** Base of Pleistocene in Los Angeles basin, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 604–605, 1966.

4100 **Bandy, Orville L.** Time-transgressive problems of California Cenozoic [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 644, 1966.

4101 **Barnes, D. F.; Lucas, W. H.; Mace, E. V.; Malloy, R. J.** Reconnaissance gravity and other geophysical data from continental end of Aleutian arc [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 644, 1966.

4029 **Barnes, David F.** Gravity changes during the Alaska earthquake: Jour. Geophys. Research, v. 71, no. 2, p. 451–456, illus., 1966.

A 1962 gravity traverse along the Richardson Highway between Valdez and Tonsina, Alaska, was repeated in September 1964 with the same instrument, and the observed changes were used to compute elevation changes produced by the March 1964 earthquake. The maximum change of elevation at any station was only about 0.6 m. Gravity changes in parts of the earthquake area where greater changes (up to 3 m) occurred indicate that the conversion factor is closer to the normal Bouguer gravity gradient than to a free-air gradient. This suggests that the elevation changes were accompanied by a net change of the total mass affecting the gravity readings, rather than by purely chemical or elastic changes.—D.B.V.

4274 **Barnes, Virgil E.** Geologic map of the Stonewall quadrangle, Gillespie and Kendall Counties, Texas: Texas Univ. Bur. Econ. Geology Geol. Quad. Map 31, scale 1:24,000, separate text, 1965.

In the Stonewall quadrangle Cambrian and Ordovician rocks occur in patchy outcrops in the Pedernales River area and northward; Cretaceous and some Quaternary surficial deposits occupy the remainder. The text describes formations ranging from the Cap Mountain Limestone Member of the Riley Formation (Upper Cambrian) to Recent alluvium. Sources of information on the Precambrian rocks are limited to gravity and magnetic data. Mineral resources of the quadrangle are mostly construction materials (dimension and crushed stone, sand and gravel, and road material) and water (mainly from Hensell Sand and Hickory Sandstone). A bibliography and a stratigraphic section are included in the text.—M.C.M.

4308 **Bayer, Thomas N.** *Desmograptus cancellatus* in the Maquoketa Formation (Ordovician) of Minnesota: Jour. Paleontology, v. 40, no. 2, p. 446–447, 1966.

This is the first report of this species in the Maquoketa.—R.E.G.

Bé, Allan W. H. *See* McIntyre, Andrew. 4265

3942 **Becker, Leroy E.; Patton, John B.** World occurrence of petroleum in pre-Silurian rocks [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 605, 1966.

4190 **Belousov, V. V.; Gzovsky, M. V.** Experimental tectonics, *in* Physics and chemistry of the Earth, V. 6: New York, Pergamon Press, p. 409–498, illus., tables, 1965.

Some of the relations which link deformations and fractures of a material with its mechanical properties and the conditions of the deformation process have been established for experimental models. Principles of model tests of tectonic phenomena, and mechanical properties of rocks and equivalent materials are summarized and the optical method of investigation of stresses in models is described. Examples are given of model tests of interstratal dislocations, folds, deformations of large sections of the crust, and tectonic faults. Experiments are effective not only in theoretical investigations but as an accompaniment to field studies.—V.S.N.

4083 **Bennyhoff, J. A.; Heizer, R. F.** Neutron activation analysis of some Cuicuilco and Teotihuacán pottery—Archaeological interpretation of results: Am. Antiquity, v. 30, no. 3, p. 348–349, 1965.

Results are presented of the application of neutron activation to determine the Mn content of clay used in 11 sherds from two sites in the Valley of Mexico. The results indicate trade between Cuicuilco and Teotihuacán.—D.B.V.

4214 **Benson, Anthony Lane.** The Devonian system in western Wyoming and adjacent areas [abs.]: Dissert. Abs., v. 26, no. 7, p. 3858, 1966.

Bentley, C. B. *See* Gillespie, J. B. 4140

3943 **Berg, Robert R.; Tenney, Charles S.** Geology of lower Permian Minnelusa oil fields, Powder River basin, Wyoming [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 605, 1966.

4165 **Berggren, W. A.** Phylogenetic and taxonomic problems of some Tertiary planktonic foraminiferal lineages [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 605–606, 1966.

4336 **Berkner, L. V.** Geophysics—Challenge and change: Geophysics, v. 31, no. 1, p. 12–16, 1966.

Resources needed for primitive technologies were simple and required elementary methods for their discovery and exploitation. The complex and expanding requirements today depend on underlying scientific understanding of the origin and concentration of the basic natural products needed for our scientific civilization; they require ever more sophisticated techniques for their discovery and economic development. To supply this scientific age is the challenge of geophysics today.—D.B.V.

4136 **Bernard, H. A.; LeBlanc, R. J.; Major, C. F.** Recent and Pleistocene geology of Southwest Texas, *reprinted in* Guidebook for Field Conference B–3, Mississippi Delta and Central Gulf Coast—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 72–117, illus., 1965; originally published 1962.

The Quaternary coastal plain of southeastern Texas forms a belt 70 to 90 miles wide, parallel to the Gulf shoreline and transected by seven major river systems. The Pleistocene portion consists of four depositional and erosional surfaces correlated with major glacial and interglacial stages. This field trip is concerned with depositional features and related sediments of these Pleistocene plains and alluvial terraces; with the Recent alluvial, deltaic, and interdeltaic plains; and with their related deposits in the Brazos Valley region.—G.D.C.

3924 **Berner, Robert A.** Chemical diagenesis of some modern carbonate sediments: Am. Jour. Sci., v. 264, no. 1, p. 1–36, illus., tables, 1966.

Mineralogy and pore water chemistry of fine-grained carbonate sediments from Bermuda and south Florida indicate that aragonite and high-Mg calcite do not tend to recrystallize to low-Mg calcite and dolomite in sediments that always have been in contact with sea water; in these sediments ratios of Mg^{++} and Sr^{++} to Cl^{-} in pore water are similar to ratios in the overlying sea water. Pore waters from brackish mangrove swamp sediments contain more Mg^{++} than would be expected from Mg^{++}/Cl^{-} ratios of the overlying brackish water and of sea water; presumably transformation from high-Mg calcite to low-Mg calcite takes place by interaction with fresh water.—E.W.W.

3944 **Berner, Robert A.** Chemical diagenesis of some modern carbonate sediments [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 606, 1966.

3910 **Bertholf, Harold W.** Timber Canyon oil field: California Div. Oil and Gas, California Oil Fields—Summ. Operations, v. 51, no. 1, p. 29–37, illus., geol. map, 1965.

Marine Eocene, Miocene, and Pliocene sedimentary rocks crop out within the Timber Canyon field, and Pleistocene nonmarine rocks are well exposed in bold dip slopes to the south. A series of high-angle cross faults influence oil accumulation. There are three distinct producing sandstone intervals in the lower Pico Formation (Pliocene). Because of the complex geology in the area, possibilities of new pool discoveries are present.—M.C.M.

4229 **Bhattacharyya, B. K.** A method for computing the total magnetization vector and the dimensions of a rectangular block-shaped body from magnetic anomalies: Geophysics, v. 31, no. 1, p. 74–96, illus., 1966.

A new method is presented for determining the horizontal dimensions, depths to top and bottom, and intensity and direction of remanent magnetization of a uniformly magnetized body of rectangular prism shape. Accuracy of computation of these parameters is highly dependent on the correct location of the center and on determination of major and minor axes of the body. An iterative method of calculation is used. The method is aided not only by the second vertical derivative map of the observed total field but also by the total field reduced to the pole and its second vertical derivative map. Factors affecting accuracy of calculations are discussed in detail. With high speed digital computers, this method can be used to great advantage for computing the above parameters of magnetized bodies giving rise to a number of anomalies over a particular area.—D.B.V.

4230 **Bhattacharyya, B. K.** Continuous spectrum of the total-magnetic-field anomaly due to a rectangular prismatic body: Geophysics, v. 31, no. 1, p. 97–121, illus., tables, 1966.

Using analytical formulas of the anomaly spectrums for magnetic field values along profiles parallel to the two horizontal axes of a rectangular prismatic body, a quantitative picture is obtained of the shift of the spectrum to the low frequency end with increase in either depth or horizontal dimension of the body, or in both. This constitutes a feasible method of separating effects of near-surface high amplitude components from those of deep crustal sources in total-field aeromagnetic maps; separation of these effects, however, is not unique. The characteristics of amplitude and phase spectrums of anomalies due to prismatic bodies of different dimensions are discussed in detail.—D.B.V.

4232 **Biot, M. A.** Three-dimensional gravity instability derived from two-dimensional solutions: Geophysics, v. 31, no. 1, p. 153–166, illus., 1966.

The theory of three-dimensional gravity instability of multi-layers is developed with particular application to salt structures. Three dimensional solutions are immediately obtained without further numerical work from the solution of the corresponding two-dimensional problem. The method is applied to the three dimensional problem of the generation of salt structures when the time-history of sedimentation is taken into account with variable thickness and compaction of the overburden; the general validity of the conclusions derived from a previous two-dimensional treatment is established. The method is valid for a wide variety of problems in theoretical physics.—D.B.V.

4244 **Birch, Francis.** Obzor nekotorykh teoriy termal'noy istorii Zemli: Akad. Nauk SSSR Izv. Ser. Geol., no. 1, p. 39–56, illus., 1966.

Present theories of the thermal history of the Earth are reviewed, and the probable stages in that history are outlined.—D.B.V.

4196 **Birkhead, Paul Kenneth.** Stromatoporoidea of Missouri [abs.]: Dissert. Abs., v. 26, no. 7, p. 3858–3859, 1966.

4143 **Black, Robert F.; Hole, Francis D.; Maher, Louis J.; Freeman, Joan E.** The Wisconsin Quaternary, *in* Guidebook for Field Conference C, Upper Mississippi Valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 56–81, illus., 1965.

The conference route in Wisconsin visits the two type localities of the Two Creeks Forest Bed and the Valders glaciation of late Wisconsin age, and the famous Driftless Area in the southwestern part of the state. It traverses typical early Wisconsinan drift in central Wisconsin, and portions of landscape that range from Precambrian igneous and metamorphic rocks and the bordering sedimentary sequence of Cambrian to Silurian age to the latest glacial and post-glacial deposits and erosional forms. Dated glacial deposits are within 30,000 to 9,500 years ago. Representative soils and one archeological site are seen also. A brief synopsis is given of the

debatable geologic history of the Devils Lake area and its buried gorge in Precambrian bedrock.—G.D.C.

3994 **Blagbrough, John Wilkinson.** Quaternary geology of the northern Chuska Mountains and Red Rock Valley, northeastern Arizona and northwestern New Mexico [abs.]: Dissert. Abs., v. 26, no. 3, p. 1589, 1965.

4197 **Blount, Charles Werner.** The solubility of anhydrite in the systems $CaSO_4$–H_2O and $CaSO_4$–$NaCl$–H_2O and its geologic significance [abs.]: Dissert. Abs., v. 26, no. 7, p. 3859, 1966.

4198 **Blusson, Stewart Lynn.** Geology and tungsten deposits near the headwaters of Flat River, Yukon, and southwest District of Mackenzie, Canada [abs.]: Dissert. Abs., v. 26, no. 7, p. 3859, 1966.

Bogard, D. D. *See* Rowe, M. W. 4003

Bowen, Vaughan T. *See* Melson, William G. 4042

4007 **Bowen, Zeddie P.** *Boucotella*, a new Silurian rhynchonelloid brachiopod genus: Jour. Paleontology, v. 40, no. 1, p. 186–189, illus., 1966.

A new rhynchonelloid brachiopod genus, *Boucotella*, is based on the species *Camarotoechia gigantea* Maynard from the Upper Silurian part of the Keyser Limestone of Virginia, West Virginia, and Maryland. *Rhynchonella tennesseensis* Roemer (in part) from the Brownsport Formation is also assigned to the genus. These two species are not congeneric with *Trigonirhynchia sulcata* Cooper from the Waldron Shale, but the three form a closely related family group. Three stages in the evolution of the cardinal process are shown by these species.—Author's abstract

Bower, M. E. *See* Godby, E. A. 3906

Bowles, Walter A. *See* Hunt, Charles B. 4084

Bright, R. C. *See* Fryxell, Roald. 3919

4026 **Bright, R. C.; Rubin, Meyer; Goode, H. D.; Morrison, R. B.; Eardley, A. J.; Richmond, G. M.** Lake Bonneville, Pt. H *in* Guidebook for Field Conference E, Northern and Middle Rocky Mountains—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 104–117, illus., 1965.

Recent studies in the Bonneville Basin and adjacent drainage areas have added new data that complicate Gilbert's simple history (1890). The new data include many radiocarbon dates, more complex stratigraphy documented by buried soils, and knowledge of flood deposits downstream from the spillover. A 30-ft higher level at Red Rock Pass and spill across a rapidly eroding alluvium-filled divide, cut by an older Lake Thatcher, is generally accepted as the probable cause of the catastrophic flooding recorded downstream. Six minor shorelines are recognized in northern Cache Valley between Bonneville and Provo levels, the latter reached about 13,900 years ago. An unusually complete sequence of deposits is exposed at Promontory Point in Little Valley, and relation to moraines is seen near Salt Lake City at the mouth of Little Cottonwood Canyon.—G.D.C.

4131 **Bristol, H. M.; Howard, R. H.** St. Louis (Mississippian) oil production in Jasper County, Illinois: Illinos Geol. Survey Illinois Petroleum 82, 21 p., illus., tables, 1966.

A well at the northern end of the Clay City Consolidated pool in St. Louis Limestone in Jasper County was completed in December 1965 for 538 bbls of oil a day, flowing from a dolomite zone at a depth of 2,940–2,961 feet. As a result of extensive drilling and testing of the St. Louis Limestone stimulated by this discovery, 16 producers have already been completed in the St. Louis that have initial production ranging from 140 to 1,200 bbls of oil per day. The probable presence of an active water

drive suggests that St. Louis production along the 45-mile-long Clay City Anticline will be controlled in part by local structural conditions. Production, much of it minor, from 26 other widely scattered pools indicates the St. Louis is a potential target in much of the Illinois Basin.—*from* Authors' abstract

4130 **Brown, A. S.** Some mercury soil profiles in British Columbia: Western Miner, v. 39, no. 2, p. 39–44, 1966.

Principles and practices in the use of mercury dispersion halos over mercury and other mineral deposits are described. Areas with highly organic or clay soils, and areas of high background are unfavorable, but this low cost technique is a valuable prospecting tool in many areas.—A.R.K.

Brown, R. J. E. *See* Legget, R. F. 4301

3895 **Browne, Ruth G.** Some Upper Cincinnatian (Ordovician) colonial corals of north-central Kentucky: Jour. Paleontology, v. 39, no. 6, p. 1177–1191, illus., 1965.

Ten species from the Richmond Group west of the Cincinnati Arch belong to the genera *Foerstephyllum* Bassler, *Staffordophyllum* Bassler, and *Calapoecia* Billings, of the Order Tabulata, and *Cyathophylloides* Dybowski of the Order Rugosa. The Waynesville, Liberty, and Whitewater Formations contain respectively one, four, and nine species, with one being common to the Waynesville and Whitewater, and three to the Liberty and Whitewater. New taxa are *Foerstephyllum vacuum magnum* n. subsp., *Staffordophyllum floweri* n. sp., and *Cyathophyllum wellsi* n. sp. *Cyathophylloides* is emended to include species previously assigned to *Favistina (Favistella)*.—R.E.G.

3945 **Bryant, William R.; Harding, James L.** Geotechnical properties of marine sediments from Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 606, 1966.

4283 **Burbank, Wilbur S.; Luedke, Robert G.** Geologic map of the Telluride quadrangle, southwestern Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-504, scale 1:24,000, sections, 1966.

4199 **Burch, Stephen Howell.** Tectonic emplacement of the Burro Mountain ultramafic body, southern Santa Lucia Range, California [abs.]: Dissert. Abs., v. 26, no. 7, p. 3860, 1966.

4248 **Burchfiel, B. C.** Tin Mountain landslide, southeastern California, and the origin of megabreccia: Geol. Soc. America Bull., v. 77, no. 1, p. 95–99, illus., 1966.

The Tin Mountain landslide deposit in southeastern California consists of approximately 2.35 billion cubic yards of megabreccia. The megabreccia is due to landsliding from steep slopes produced by a fault. Thus, the Tin Mountain landslide deposit confirms the landslide interpretation proposed by many workers for numerous megabreccia occurrences in the Basin and Range province.—Author's abstract

Burckle, Lloyd H. *See* Saito, Tsunemasa. 4310

4103 **Burk, C. A.** Geologic history of Alaska Peninsula [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 645, 1966.

4040 **Burnett, D. S.; Fowler, William A.; Hoyle, Fred.** Nucleosynthesis in the early history of the solar system: Geochim. et Cosmochim. Acta, v. 29, no. 12, p. 1209–1241, illus., tables, 1965.

In a revised nucleosynthesis model, the D, Li, Be, and B are produced by spallation reactions, mainly on O-16, in metric-sized planetesimals. A fraction of the large numbers of neutrons which are also produced react to produce the terrestrial Li and B isotopic ratios. The new model is compatible with suggestions that the Moon has a high water content and that biotic material has formed in the carbonaceous chondrites and on the lunar surface. The similarity of isotopic composition of Li,

Gd, and K in stone meteorites and terrestrial rocks implies that Earth and meteorites had a common initial history.—D.B.V.

4286 **Burnham, Charles W.** Computation of absorption corrections, and the signifcance of end effect: Am. Mineralogist, v. 51, nos. 1–2, p. 159–167, illus., tables, 1966.

A method of computing transmission factors using Gaussian quadrature numerical integration for crystals whose shape can be described by plane faces has been programmed specifically for equi-inclination Weissenberg diffraction geometry . . . The method has been used to investigate the magnitude of end effect inherent in cylindrical absorption corrections for non-equatorial, or upper-level reflections . . .—Author's abstract

3946 **Burst, John F.** Diagenesis of Gulf Coast clayey sediments and its possible relation to petroleum migration [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 607, 1966.

Buschbach, T. C. *See* Swann, David H. 4058

4303 **Buseck, Peter R.; Mason, Brian; Wiik, H. B.** The Farmington meteorite—Mineralogy and chemistry: Geochim. et Cosmochim. Acta, v. 30, no. 1, p. 1–8, illus., tables, 1966.

The Farmington hypersthene chondrite is a dense black meteorite that has been shocked and partly brecciated. The mineralogic composition and structure are described. Electron probe microanalysis indicates that the metal throughout the meteorite is compositionally inhomogeneous, raisng the possiblity that it may not be indigenous. Chemical analysis shows that it belongs to the L-group of chondrites.—D.B.V.

4247 **Butler, James Robert.** Geologic evolution of the Beartooth Mountains, Montana and Wyoming—Pt. 6, Cathedral Peak area, Montana: Geol. Soc. America Bull., v. 77, no. 1, p. 45–64, illus., tables, geol. map, 1966.

Postulated major events are: (1) deposition of a sedimentary sequence, (2) formation of open folds, (3) regional metamorphism to predominantly amphibolite facies, with granitization and pegmatite formation, (4) emplacement of the Stillwater Complex at the northeast margin of the area, (5) regional metamorphism and pegmatite formation about 2700 m.y. ago, (6) intrusion of late Precambrian dolerite dikes, and, (7) Laramide orogeny with alteration and retrograde metamorphism along fault zones. The predominant rock type, granite gneiss, was probably formed by granitization.—J.J.H.

4024 **Butterman, William Charles.** Equilibrium phase relations among oxides in the systems GeO_2, GeO_2–B_2O_3, HfO_2–B_2O_3, ZrO_2–SiO_2–B_2O_3, and ZrO_2–SiO_2 [abs.]: Dissert. Abs., v. 26, no. 4, p. 2246, 1965.

4299 **Byerly, P. Edward.** Interpretations of gravity data from the Central Coast Ranges and San Joaquin Valley, California: Geol. Soc. America Bull., v. 77, no. 1, p. 83–94, illus., 1966.

A Bouger anomaly profile across the central Coast Ranges and San Joaquin Valley shows negative anomalies of several tens of milligals. These anomalies are related to Tertiary sedimentary basins of local extent in which available rock densities are relatively low. The serpentine body at Joaquin Ridge presumably is not underlain by ultramafic rocks. Models suggest that this part of the Diablo Range is in approximate isostatic equilibrium although the small magnitudes of the anomalies preclude significant calculations. Variations in rock structure and composition are indeterminate.—J.G.V.

4104 **Byrne, John V.; Kulm, L. D.; Maloney, Neil J.** Textural trends of Recent sediments from river to abyssal plain off Oregon [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 645–646, 1966.

Cabri, L. J. *See* Kracek, F. C. 4328

4302 **California Dept. Water Resources.** Dispersion and persistence of synthetic detergents in ground water, San Bernardino and Riverside Counties: California Water Quality Control Board Pub. 30, 67 p., illus., tables, 1965.

The San Jacinto fault and Rialto–Colton Barrier affect the movement of ground water in the area under investigation which is a reach of the Santa Ana River. Older alluvium, containing several aquifers, is the primary water-bearing zone. The report includes chapters on development of methods and sampling techniques; ABS (alkyl benzene sulfonate) concentrations in waste, surface and ground waters; transport and degradation of ABS in surface and ground waters; mixing and dispersion in a ground water basin; and findings, conclusions, and recommendations. Appendixes include a bibliography, analyses of selected constituents of ground water, general geology of the area, and test well logs.—M.C.M.

Calkins, Parker. *See* Cazeau, Charles J. 4178

Cameron, C. P. *See* Weidie, A. E. 4092

Cameron, Christopher P. *See* Weidie, Alfred E. 4091

Cameron, E. N. *See* Ramsden, A. R. 4290

4008 **Camp, C. L.; Koch, John G.** Late Jurassic ichthyosaur from coastal Oregon: Jour. Paleontology, v. 40, no. 1, p. 204–205, illus., 1966.

The toothed forward mid-section of the upper and lower jaws of an ichthyosaur were collected about 10 miles south of Port Orford. In several respects it resembles *Ichthyosaurus franciscanus* and *I. californicus* from the Franciscan Formation of California.—F.C.W.

3929 **Canada Geological Su[illegible].** Aeromagnetic map, Lac Léran, Quebec: Canada Geol. Survey Geophysics Paper 2045, scale 1:63,360, 1965.

4343 **Canada Geological Survey.** Aeromagnetic map, Lac Conflans, Quebec: Canada Geol. Survey Geophysics Paper 2068, scale 1:63,360, 1965.

4344 **Canada Geological Survey.** Aeromagnetic map, Lac Bréhat, Quebec: Canada Geol. Survey Geophysics Paper 2069, scale 1:63,360, 1965.

4345 **Canada Geological [illegible]ey.** Aeromagnetic map, Lac Naococane, Quebec: Canada Geol. Survey Geophysics Paper 2070, scale 1:63,360, 1965.

4346 **Canada Geological Survey.** Aeromagnetic map, Lac Gommard, Quebec: Canada Geol. Survey Geophysics Paper 2071, scale 1:63,360, 1965.

4347 **Canada Geological Survey.** Aeromagnetic map, Lac du Raccourci, Quebec: Canada Geol. Survey Geophysics Paper 2072, scale 1:63,360, 1965.

4348 **Canada Geological Survey.** Aeromagnetic map, Lac des Prairies, Quebec: Canada Geol. Survey Geophysics Paper 2073, scale 1:63,360, 1965.

4349 **Canada Geological Survey.** Aeromagnetic map, Lac Manouanis, Quebec: Canada Geol. Survey Geophysics Paper 2074, scale 1:63,360, 1965.

4350 **Canada Geological Survey.** Aeromagnetic map, Michipicoten Bay, Ontario: Canada Geol. Survey Geophysics Paper 7078, scale 1:253,440, 1965.

4351 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 D/16, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3193, scale 1:63,360, 1965.

4353 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/3, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3195, scale 1:63,360, 1965.

4354 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/2, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3196, scale 1:63,360, 1965.

4355 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/1, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3197, scale 1:63,360, 1965.

4356 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/4, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3198, scale 1:63,360, 1965.

4357 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/3, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3199, scale 1:63,360, 1965.

4358 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/2, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3200, scale 1:63,360, 1965.

4359 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/1, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3201, scale 1:63,360, 1965.

4360 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 H/4, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3202, scale 1:63,360, 1965.

4361 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 H/3, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3203, scale 1:63,360, 1965.

4362 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 H/2, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3204, scale 1:63,360, 1965.

4363 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 H/1, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3205, scale 1:63,360, 1965.

4364 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 E/4, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3206, scale 1:63,360, 1965.

4365 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 E/3, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3207, scale 1:63,360, 1965.

4366 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 E/2, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3208, scale 1:63,360, 1965.

4367 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 E/1, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3209, scale 1:63,360, 1965.

4368 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/5, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3210, scale 1:63,360, 1965.

4369 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/6, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3211, scale 1:63,360, 1965.

4370 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/7, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3212, scale 1:63,360, 1965.

4371 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/8, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3213, scale 1:63,360, 1965.

4372 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/5, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3214, scale 1:63,360, 1965.

4373 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/6, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3215, scale 1:63,360, 1965.

4374 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/7, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3216, scale 1:63,360, 1965.

4375 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/8, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3217, scale 1:63,360, 1965.

4376 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 H/5, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3218, scale 1:63,360, 1965.

4377 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 H/6, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3219, scale 1:63,360, 1965.

4378 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 H/7, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3220, scale 1:63,360, 1965.

4379 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 H/8, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3221, scale 1:63,360, 1965.

4380 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 E/5, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3222, scale 1:63,360, 1965.

4381 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 E/6, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3223, scale 1:63,360, 1965.

4382 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 E/7, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3224, scale 1:63,360, 1965.

4383 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 E/8, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3225, scale 1:63,360, 1965.

4384 **Canada Geological Survey.** Aeromagnetic map, Maguse Point, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3226, scale 1:63,360, 1965.

4385 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/12, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3227, scale 1:63,360, 1965.

4386 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/11, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3228, scale 1:63,360, 1965.

4387 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/10, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3229, scale 1:63,360, 1965.

4388 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 F/9, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3230, scale 1:63,360, 1965.

4389 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/12, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3231, scale 1:63,360, 1965.

4390 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/11, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3232, scale 1:63,360, 1965.

4391 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/10, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3233, scale 1:63,360, 1965.

4392 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 G/9, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3234, scale 1:63,360, 1965.

4393 **Canada Geological Survey.** Aeromagnetic map, Camborne, Kootenay District, British Columbia: Canada Geol. Survey Geophysics Paper 3235, scale 1:63,360, 1965.

4394 **Canada Geological Survey.** Aeromagnetic map, Illecillewaet, Kootenay District, British Columbia: Canada Geol. Survey Geophysics Paper 3236, scale 1:63,360, 1965.

4395 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 I/13, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3513, scale 1:63,360, 1965.

4396 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 I/14, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3514, scale 1:63,360, 1965.

4397 **Canada Geological Survey.** Aeromagnetic map, Ferguson Lake, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3515, scale 1:63,360, 1965.

4398 **Canada Geological Survey.** Aeromagnetic map, Sheet 65 I/16, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3516, scale 1:63,360, 1965.

4399 **Canada Geological Survey.** Aeromagnetic map, Kaminuriak Lake South, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3517, scale 1:63,360, 1965.

4400 **Canada Geological Survey.** Aeromagnetic map, Mandreville Lake, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3518, scale 1:63,360, 1965.

4401 **Canada Geological Survey.** Aeromagnetic map, Duffy Lake, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3519, scale 1:63,360, 1965.

4402 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 L/16, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3520, scale 1:63,360, 1965.

4403 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 K/13, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3521, scale 1:63,360, 1965.

4404 **Canada Geological Survey.** Aeromagnetic map, Sheet 55 K/14, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3522, scale 1:63,360, 1965.

4405 **Canada Geological Survey.** Aeromagnetic map, Diana Lake, District of Keewatin, Northwest Territories: Canada Geol. Survey Geophysics Paper 3523, scale 1:63,360, 1965.

4406 **Canada Geological Survey.** Aeromagnetic map, Ville-Marie, Quebec-Ontario: Canada Geol. Survey Geophysics Paper 7075, scale 1:253,440, 1965.

4407 **Canada Geological Survey.** Aeromagnetic map, Chapleau, Ontario: Canada Geol. Survey Geophysics Paper 7077, scale 1:253,440, 1965.

4408 **Canada Geological Survey.** Aeromagnetic map, Missinaibi Lake, Ontario: Canada Geol. Survey Geophysics Paper 7086, scale 1:253,440, 1965.

4409 **Canada Geological Survey.** Aeromagnetic map, White River, Ontario: Canada Geol. Survey Geophysics Paper 7087, scale 1:253,440, 1965.

4410 **Canada Geological Survey.** Aeromagnetic map, Schreiber, Ontario: Canada Geol. Survey Geophysics Paper 7088, scale 1:253,440, 1965.

4411 **Canada Geological Survey.** Aeromagnetic map, Thunder Bay, Ontario: Canada Geol. Survey Geophysics Paper 7089, scale 1:253,440, 1965.

4412 **Canada Geological Survey.** Aeromagnetic map, Quetico, Ontario: Canada Geol. Survey Geophysics Paper 7090, scale 1:253,440, 1965.

4413 **Canada Geological Survey.** Aeromagnetic map, Rainy Lake, Ontario: Canada Geol. Survey Geophysics Paper 7091, scale 1:253,440, 1965.

4414 **Canada Geological Survey.** Aeromagnetic map, Longlac, Ontario: Canada Geol. Survey Geophysics Paper 7102, scale 1:253,440, 1965.

4415 **Canada Geological Survey.** Aeromagnetic map, Nipigon, Ontario: Canada Geol. Survey Geophysics Paper 7103, scale 1:253,440, 1965.

4416 **Canada Geological Survey.** Aeromagnetic map, Ignace, Ontario: Canada Geol. Survey Geophysics Paper 7104, scale 1:253,440, 1965.

4417 **Canada Geological Survey.** Aeromagnetic map, Dryden, Ontario: Canada Geol. Survey Geophysics Paper 7105, scale 1:253,440, 1965.

4418 **Canada Geological Survey.** Aeromagnetic map, Churchill, Manitoba: Canada Geol. Survey Geophysics Paper 7144, scale 1:253,440, 1965.

4419 **Canada Geological Survey.** Aeromagnetic map, Caribou River, Manitoba: Canada Geol. Survey Geophysics Paper 7148, scale 1:253,440, 1965.

4420 **Canada Geological Survey.** Aeromagnetic map, Nejanilini Lake, Manitoba: Canada Geol. Survey Geophysics Paper 7149, scale 1:253,440, 1965.

4421 **Canada Geological Survey.** Aeromagnetic map, Munroe Lake, Manitoba: Canada Geol. Survey Geophysics Paper 7150, scale 1:253,440, 1965.

4137 **Carbonneau, C.; Caron, J. C.** The production of pyrochlore concentrates at St. Lawrence Columbium and Metals Corp.: Canadian Mining and Metall. Bull., v. 58, no. 635, p. 281–289, 1965.

The ore is particularly complex, as it is made up of an elaborate intermingling of carbonates and discontinuous ultra-alkaline rock bodies of various ages and types in which no less than seventy minerals have been reported. Obvious petrographic or structural controls are lacking. Ore boundaries have to be defined on the basis of assay results and the determination of several minerals which occur in trace amounts. The pyrochlore concentrates produced had to comply with a set of stringent specifications. This fact, combined with the low Cb_2O_5 content of the ore, necessitated the use of a beneficiation process that would have to operate at a concentration ratio greater than 100:1.—Authors' abstract

Caron, J. C. *See* Carbonneau, C. 4137

4291 **Carpenter, A. B.; Chalmers, R. A.; Gard, J. A.; Speakman, K.; Taylor, H. F. W.** Jennite, a new mineral: Am. Mineralogist, v. 51, nos. 1–2, p. 56–74, illus., tables, 1966.

Jennite is a new hydrous sodium calcium silicate occurring in late stage contact rock at Crestmore, Calif. Thermal curves show jennite loses water and forms metajennite at 70–90°C. Optical properties, X-ray unit cell and powder data, infrared curves, and chemical analysis are given.—M.L.L.

Carpenter, Alden B. *See* Wicklein, Phillip. 4185

4043 **Carr, Jerome B.** Permanency of the continents: Nature, v. 209, no. 5021, p. 341–348, illus., tables, 1966.

In the light of new ocean bottom data confirming the existence of the worldwide shear pattern, structural data of continental interiors dating the shear pattern as at least 2,800 m.y. old, and independent heat-flow data and the distribution of volcanoes, it is concluded that the majority of the Earth's major topographic and geologic features are controlled by, or grew along, major zones of weakness generated as part of the worldwide shear pattern. The preservation of this shear pattern on the ocean bottom for 2,800 m.y. firmly enforces the theory of permanency of continents.—D.B.V.

Carr, W. J. *See* Lipman, P. W. 4271

4000 **Carter, N. L.; Kennedy, G. C.** Origin of diamonds in the Canyon Diablo and Novo Urei meteorites—A reply [to discussion of 1964 paper by E. Anders and M. E. Lipschutz, 1966]: Jour. Geophys. Research, v. 71, no. 2, p. 663–672, illus., table, 1966.

Much in the thesis of Anders and Lipschutz (ibid., p. 643–661) does not agree with observations on three diamond-bearing specimens of the Canyon Diablo meteorite. As shown by Heymann, Lipschutz, Nielsen, and Anders (ibid., p. 619–641), moderately shocked specimens are statistically as likely to contain diamonds as heavily shocked specimens. Furthermore, the presence of octahedral diamonds in Novo Urei strongly supports the view that diamonds formed by normal static processes.—D.B.V.

4284 **Cattermole, J. Mark.** Geologic map of the Fountain City quadrangle, Knox County, Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ-513, scale 1:24,000, sections, 1966.

4178 **Cazeau, Charles J.; Calkins, Parker.** Buffalo and Niagara Falls, *in* Guidebook for Field Conference A, New England-New York State—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 85–90, illus., 1965.

Southeast of Buffalo are seen strandline deposits of pro-glacial lakes, where recessional moraines are topographically subdued. North of the Onondaga Escarpment the floor of former Lake Tonawanda lies on the dip slope of the Niagara Cuesta; its last vestiges persist in extensive swamplands. The largest of the multiple outlets crossed the escarpment by way of The Gulf at Lockport. Below the Niagara Escarpment is the strandline of Lake Iroquois. Estimates of postglacial time obtained by the rate of cutting of Niagara Gorge is complicated by a reach of a drift-filled interglacial gorge. Factors in the variability of recession of the Falls include diminishing height due to regional dip of the capping Lockport dolomite, its southward thickening, and diminished discharge of the Niagara River.—G.D.C.

Chalmers, R. A. *See* Carpenter, A. B. 4291

3938 **Chapman, Carleton A.** Paucity of mafic ring-dikes—Evidence for floored polymagmatic chambers: Am. Jour. Sci., v. 264, no. 1, p. 66–77, illus., 1966.

In monomagmatic chambers density differences between overlying country rock and magma should, following development of ring fractures, result in mafic ring dikes above mafic magma, and in foundering of the roof into felsic magma with the development of felsic stocks. The observed prevalence of felsic ring dikes may be due to shallow floors in felsic magma chambers, or to shallow constructed floors at the top of the mafic fraction in polymagmatic chambers.—H.R.C.

3947 **Chave, Keith E.** Early diagenesis of carbonate particles in clastic sediments [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 607, 1966.

4227 **Cherry, J. T.; Hurdlow, W. R.** Numerical simulation of seismic disturbances: Geophysics, v. 31, no. 1, p. 33–49, illus., 1966.

The technique is described and results are presented from a Lagrangian numerical scheme of calculating cylindrically symmetric, elastic-plastic, transient disturbances. Five numerical solutions of various elastic-plastic wave propagation problems are presented; these solutions agree extremely well with their corresponding analytical and experimental solutions. A shear and tensile failure mechanism is presented that is consistent with the continuum hypothesis and gives good results when applied to alluvium at Nevada Test Site; data for hard rock are not yet available.—D.B.V.

Choquette, Philip W. *See* Pray, Lloyd C. 4120

Cifelli, Richard. *See* Towe, Kenneth M. 4061

Clay, C. S. *See* Rona, Peter A. 4341

Coleman, R. G. *See* Hostetler, P. B. 4292

4044 **Conhaim, H. J.** William H. Elson (1895–1965): Am. Assoc. Petroleum Geologists Bull., v. 49, no. 12, p. 2317–2318, portrait, 1965.

3949 **Conolly, John R.; Ewing, Maurice.** Modern graded beds and turbidity currents—Case history [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 608–609, 1966.

Conrey, Bert L. *See* Greene, Herbert G. 4109

3914 **Cordova, Simon.** Horse Meadows oil field: California Div. Oil and Gas, California Oil Fields—Summ. Operations, v. 51, no. 1, p. 61–65, illus., tables, 1965.

The structure of the Horse Meadows field is a tight, southwesterly plunging anticlinal nose lying between two prominent reverse faults, the Devonshire and the Hadley, neither of which appears to have had a direct effect upon oil accumulation. Formations (Cretaceous to lower Pleistocene) present in the field are listed and described in a table. The producing zone is in the upper portion of the Cretaceous section.—M.C.M.

4105 **Corey, William H.** Southern California and offshore Tertiary basins [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 646, 1966.

Cox, Allan. *See* Doell, Richard R. 4037

4177 **Cox, Donald D.** Palynology in New York, *in* Guidebook for Field Conference A, New England–New York State—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci. p. 62–65, illus., 1965.

Late glacial correlations have been attempted in very few pollen studies in New York State and consequently no distinctive vegetative zones have been identified as characteristic of the Valders advance, the Two Creeks interstadial, or earlier glacial events. One study in north-central New York, Crusoe Lake, has suggested that a warming trend during the Two Creeks interstadial permitted spruce to become established in the area and that the Valders advance was characterized by a decrease in spruce and an increase in herbaceous plants. Pollen profiles from here and other areas indicate that ice retreated and a closed spruce-pine-fir forest became established in New York before 7500 B.C.—G.D.C.

3950 **Craig, R. W.** Alaska, new frontier for oil [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 609, 1966.

Crawford, Ellis. *See* Ray, Louis L. 4148

4273 **Crowder, D. F.; Tabor, R. W.; Ford, A. B.** Geologic map of the Glacier Peak quadrangle, Snohomish and Chelan Counties, Washington: U.S. Geol. Survey Geol. Quad. Map GQ-473, scale 1:62,500, sections, 1966.

The map sheet includes tables showing textures, composition, structures, and so forth, of granitoid and gneissic rocks and of schistose and gneissic rocks; figures indicating normative composition of Glacier Peak volcanic rocks and modal composition of Miocene Cloudy Pass pluton and Miocene(?) stocks and plugs; and a generalized geologic map showing distribution and relative abundance of light-colored dikes, sills, and irregular masses.—M.C.M.

3912 **Crowder, Robert E.** Del Amo zone of Torrance oil field: California Div. Oil and Gas, California Oil Fields—Summ. Operations, v. 51, no. 1, p. 47–52, illus., tables, 1965.

Marine sediments (middle Miocene to Recent) were laid down in a basin of continuous deposition as evidenced by the absence of unconformities in the zone of the Torrance oil field; they rest unconformably on a metamorphic schist ridge of Jurassic age. The formations are listed and described in a table. Torrance field lies along a northwest-trending schist ridge which extends from Long Beach Harbor to Santa Monica Bay. Most of the faults are northerly striking normal faults which appear to have little effect on the accumulation of oil in the Del Amo zone, the deepest producing interval in the field.—M.C.M.

3996 **Crozier, W. D.** Nine years of continuous collection of black, magnetic spherules from the atmosphere: Jour. Geophys. Research, v. 71, no. 2, p. 604–611, illus., 1966.

The average annual accretion to the Earth of presumably extraterrestrial magnetic spherules of 5 to 60μ diameter, according to data collected at two stations in New Mexico in the period 1956–64, was about 1.04×10^{11}g. As this period included two years with an annual infall of nearly 2.5×10^{11}g, the long-term average remains somewhat uncertain. Interesting seasonal and biennial patterns appear in the deposition rate, and there seems to be a correlation between spherule rates and radar meteor rates, the spherule rates leading the radar rates by about six weeks. High rates of spherule deposition in 1963 coincide with unusually high radar rates.—D.B.V.

Cushing, J. *See* Wright, H. E., Jr. 4187

Dale, O. C. *See* Myers, B. N. 4138

Dalrymple, G. Brent. *See* Doell, Richard R. 4037

Dalrymple, G. Brent. *See* Lanphere, Marvin A. 4259

David, Marthann. *See* Forgotson, James M., Jr. 3899

Davids, Robert N. *See* Olsson, Richard K. 4114

4012 **Davidson, Edward.** A new Paleocene crab from Texas: Jour. Paleontology, v. 40, no. 1, p. 211–213, illus., 1966.

Kierionopsis nodosa n. gen. et sp. is described from the Wills Point Formation of the Midway Group, in Freestone County.—R.E.G.

Davis, Dan A. *See* Ward, Porter E. 4089

4153 **Davis, Richard A., Jr.** Ordovician algal stromatolites in upper Mississippi Valley [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 609–610, 1966.

Denison, Robert H. *See* Rolfe, W. D. Ian. 4013

Dennen, William H. *See* Ritter, Charles J. 4266

4245 **Dennis, John G.; Waler, Charles T.** Earthquakes resulting from metastable phase transitions: Tectonophysics, v. 2, no. 5, p. 401–407, illus., 1965.

. . . Slow currents in the Earth's mantle contained between phase discontinuities could generate effects resulting in the transport of a mineral assemblage from one pressure–temperature environment to another. If the pressure–volume changes in these currents are essentially adiabatic the pressure–temperature environment near a phase discontinuity would be favourable for spontaneous phase transitions, even though the environment at the phase discontinuity in the surrounding mantle was that of equilibrium. Thus, the hypothesis that deep and intermediate earthquakes are triggered by sudden volume changes is consistent with thermodynamic considerations.—Authors' abstract

4154 **Dennison, John M.; Morrison, Anne K.** Facies relations of hystrichospheres in Onesquethaw Stage (Devonian) of central Appalachians [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 610, 1966.

3916 **Denson, N. M.; Richmond, G. M.; Haynes, C. V.; Irwin, H. T.; Irwin-Williams, C.; Agogino, G. A.; Montagne, John M. de la; Love, J. D.** Late Tertiary history of the mountains, Pt. B *in* Guidebook for Field Conference E, Northern and Middle Rocky Mountains—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 14–27, illus., table, 1965.

The nature and extent of the physiographic development of the mountains just previous to Quaternary events, was not uniform throughout the Rocky Mountains. In Wyoming the relation of the Tertiary deposits of the High Plains to the summit erosion surface on the Laramie Range and to uplift of the mountains and canyon cutting are seen in the Cheyenne–Laramie region. A Pleistocene pediment rises 600 feet above streams in the Laramie Basin, west of which are glaciation features of the Medicine Bow Mts. The relation of Tertiary drainiage changes to uplift and collapse of a mountain arch is seen in the North Platte and Sweetwater Rivers canyons in the Seminoe Mountains. The Granite Mountains are the core of an arch, downfaulted, buried, and partly stripped in late Pliocene time.—G.D.C.

Denson, N. M. *See* Richmond, G. M. 3917

4195 **Dietz, Earl Daniel.** A study of the superheating of an albite feldspar [abs.]: Dissert. Abs., v. 26, no. 7, p. 3806, 1966.

3936 **Dietz, Robert S.; Holden, John C.** Deep-sea deposits in but not on the continents: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 351–362, illus., table, 1966.

World-wide review and tabulation of localities of deep-sea deposits of radiolarian chert, graptolite shale, and graywacke indicate that these occur almost exclusively in eugeosynclinal facies. To explain such deposits in continents, the authors propose a recurrent process whereby a prism of ensimatic, eugeosynclinal sediments accumulates on the ocean floor against the continental slope, to constitute a (modern) continental rise. Thrusting from the sea floor, via mantle current convection, eventually folds this prism against, and into rather than onto, the continental plate, resulting in alpine-type flysch mountains and continental accretion. This "actualistic" concept obviates interchange of level between continents and ocean basins and sustains that part of the (Dana) Doctrine of Permanency that pertains to vertical permanency of continents and ocean basins. Bibliography is comprehensive.—B.H.K.

4106 **Dietz, Robert S.; Holden, John C.** Mioclines in space and time [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 646, 1966.

4281 **Dixon, H. Roberta; Pessl, Fred, Jr.** Geologic map of the Hampton quadrangle, Windham County, Connecticut: U.S. Geol. Survey Geol. Quad. Map GQ-468, scale 1:24,000, sections, 1966.

4037 **Doell, Richard R.; Dalrymple, G. Brent; Cox, Allan.** Geomagnetic polarity epochs—Sierra Nevada data, [Pt.] 3: Jour. Geophys. Research, v. 71, no. 2, p. 531–541, tables, 1966.

Available paleomagnetic and radiometric results for about 60 igneous rocks 3.6 m.y. old or less are consistent with the following geomagnetic polarity epoch time scale: Brunhes (normal), 0.0 to 0.85±0.15 m.y.; Matuyama (reversed), 0.85±15 to 2.4±0.1 m.y.; Gauss (normal), 2.4±0.1 to 3.35±0.1 m.y.; Gilbert (reversed), 3.35±0.1 m.y. to (?). A brief interval of normal polarity (the Olduvai event) occurs within the Matuyama epoch at about 1.9 m.y., and a brief interval of reversed polarity (the Mammoth event) occurs within the Gauss epoch at about 3.06 m.y. Data for 12 units from eastern California and Nevada, reported here for the first time, are particularly useful in defining the Gauss–Gilbert boundary and for recognizing the Mammoth event.—*from* Authors' abstract

4156 **Donath, Fred A.** Effects of ductility and planar anisotropy in folding of rock layers [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 610, 1966.

4320 **Donnay, Gabrielle; Ingamells, C. O.; Mason, Brian.** Buergerite, a new species of tourmaline: Am. Mineralogist, v. 50, nos. 1–2, p. 198–199, 1966.

The name buergerite is proposed for any tourmaline having as its major component an idealized end member containing sodium and ferric iron. Analyses are given of tourmaline from Mexquitic, San Luis Potosí, Mexico. Unit cell dimensions are a 15.873, c 7.187 A.—M.L.L.

4155 **Dott, Robert H., Jr.** Cohesion and flow phenomena in clastic intrusions [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 610–611, 1966.

4238 **Dougherty, E. L.; Smith, S. T.** The use of linear programming to filter digitized map data: Geophysics, v. 31, no. 1, p. 253–259, illus., 1966.

Linear programming can be applied to give more satisfactory results than the least squares method in checking for errors during data processing. In this approach, the sum of the absolute values of the deviations is minimized, rather than the squares of the deviations. The formulation of linear programming is described in detail, and an example of its use is given. Through this formulation, once errors are removed the results are meaningful physically and can be used for detecting subsurface phenomena directly.—D.B.V.

4157 **Douglas, Robert; Sliter, W. V.** Distribution of Late Cretaceous Rotaliporidae and Globotruncanidae in California and northwestern Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 611, 1966.

4253 **Doyle, F. L.** Geology of the Freeport quadrangle, Illinois: Illinois Geol. Survey Circ. 395, 24 p., illus., geol. map, 1965.

Exposed bedrock in the Freeport quadrangle consists of the Platteville and Galena Dolomites of the Ordovician Champlainian Series; underlying St. Peter and Glenwood Formations are covered by Recent alluvium along major valleys; and Maquoketa Shale of the Cincinnatian Series overlies the Galena in a small area. Altonian glaciers deposited thin drift over the maturely eroded bedrock, the dolomite being deformed by ice shove in many places. Meltwater from ice deposited sand and gravel in the form of kame terraces and complexes, eskers, and crevasse fillings. Overflow from the lakes cut new steep-walled valleys. Lenses of sandy silts overlie the till in places. The Winnebago drift was slightly weathered before a widespread mantle of Peoria Loess (about 3 1/2 feet thick) was deposited during Woodfordian time. Resources include dolomite, sand, gravel, and water supplies in shallow aquifers.—*from* Author's abstract

Drake, Avery Ala, Jr. *See* Moench, Robert H. 4323

4150 **Dreimanis, Alexsis; Karrow, Paul F.** Southern Ontario, *in* Guidebook for Field Conference G, Great Lakes–Ohio River valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 90–110, illus., tables, 1965.

Most of the Pleistocene deposits of southern Ontario are of Wisconsin age; those in the area of the Ontario–Erie glacial lobe were visited in this part of the conference. Texture, fabric, and lithology help to distinguish various till horizons and outline the extent of main lobes. Palynology has been useful for deciphering the climatic conditions of nonglacial intervals, and radiocarbon dates for the stratigraphy of the last ice age. Proglacial-lake shorelines are higher than their counterparts southwest of Lake Erie.—G.D.C.

3952 **Drugg, Warren S.** Late Cretaceous–Paleocene phytoplankton, upper Moreno Formation, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 611, 1966.

4334 **Duda, Seweryn J.** Secular seismic energy release in the circum-Pacific belt: Tectonophysics, v. 2, no. 5, p. 409–452, illus., tables, 1965.

On the basis of data of earthquakes of $M \geq 7.0$ recorded over the period 1897–1964, the circumpacific belt is divided into eight regions of different intensities of strain energy release and statistically different b-coefficients in the recurrence diagrams which relate number of earthquakes to magnitude. Correlation of intensities and b-coefficients shows that the latter is dependent on stress pattern. The b-coefficients vary significantly from region to region; highest value is found for the New Hebrides–Solomon Islands–New Guinea region and lowest for the Aleutians–Alaska region. During an aftershock sequence stress is reduced consecutively which should cause the b-coefficient to increase with time. The seismic energy release per year in shallow and intermediate earthquakes has decreased significantly in the 68-year period.—V.S.N.

Eardley, A. J. *See* Bright, R. C. 4026

3953 **Ebanks, William J., Jr.; Tebbutt, Gordon E.** Diagenetic modification of Recent sediments associated with a limestone island [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 611–612, 1966.

4064 **Ebeoglu, D. B.; Wainio, K. M.; More, K.; Tiffany, O. L.** Monte Carlo calculations of radionuclide production in iron targets bombarded with 400-Mev protons: Jour. Geophys. Research, v. 71, no. 5, p. 1445–1451, illus., 1966.

The effective production rates of a number of radionuclides have been calculated in iron targets bombarded with a monoenergetic, collimated beam of 400-Mev protons, in order to study the cosmic-ray interaction in meteorites and follow nuclear cascades in multielement, multilayer targets. From the results it is concluded that cosmogenic effects can be accurately and fairly rapidly predicted not only in iron meteorites but in any material of known composition and for any given proton flux.—D.B.V.

4107 **Elliott, William J.** Gravity survey and analysis of San Diego Embayment, southwest San Diego County, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 646–647, 1966.

4108 **Enlows, Harold E.; Oles, Keith F.** Authigenic silicates in marine Spencer Formation at Corvallis, Oregon [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 647, 1966.

4025 **Erdman, J. Gordon.** Petroleum—Its origin in the earth, *in* Fluids in subsurface environments—A symposium: Am. Assoc. Petroleum Geologists Mem. 4, p. 20–52, illus., tables, 1965.

Crude oil represents a very small proportion of the carbonaceous matter preserved in the Earth. The marine environment seems to have been most favored for its genesis, reflecting chemical composition of source material, path of diagenesis, or proximity of suitable traps. Most investigators believe that plant and animal detritus is the ultimate source material, but the chemical compositon of marine organisms is not proving to be as different from that of terrestrial organisms as has been assumed. A long and complex chemistry is indicated in the conversion, along definite reaction pathways governed by subsurface environment. The geochemist hopes to be able to describe how and why.—G.D.C.

4264 **Ernst, W. G.** Synthesis and stability relations of ferrotremolite: Am. Jour. Sci., v. 264, no. 1, p. 37–65, illus., tables, 1966.

Phase relations for the bulk composition $2CaO{\cdot}5FeO_2{\cdot}8SiO_2+H_2O$ at moderate temperatures and fluid pressures, and low oxygen fugacity (fO_2) values, indicate a field of stability for the amphibole ferrotremolite, $Ca_2Fe_5Si_8O_{22}(OH)_2$. With fO_2 defined by the magnetite–iron buffer, ferrotremolite is stable up to 437°C at 500 bars, 543°C at 3,000 bars; the high-temperature assemblage of equivalent composition consists of fayalite+quartz+hedenbergitic pyroxene+fluid. With fO_2 specified by the magnetite+quartz–fayalite buffer, the amphibole high-temperature stability limit is reduced about 4°C, and magnetite accompanies the other high-temperature phases. At still higher fO_2 values, represented by the Ni–NiO_2 buffer, ferrotremolite is not stable at any temperature. Reasons for restriction of ferrotremolite in nature are examined.—P.B.H.

Evans, B. W. *See* Hostetler, P. B. 4292

Evenson, R. E. *See* Miller, G. A. 4257

3898 **Ewing, Maurice; Antoine, John.** New seismic data concerning sediments and diapiric structures in Sigsbee Deep and upper continental slope, Gulf of Mexico: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 479–504, illus., 1966.

An Electro-Sonic Profiler (ESP) and Precision Depth Recorder (PDR) survey was made from Galveston across Sigsbee Deep to Campeche Shelf and back. Campeche Shelf is a constructional continental-shelf terrace, involving both upbuilding and outbuilding, and its contribution of sediments toward the north is slight. Several new knolls and domes reported in Sigsbee Deep are believed to be diapirs. Numerous diapiric structures, found from Sigsbee Scarp northward toward the continental shelf, suggest continuity of the belt of diapirs from the U.S. Gulf Coast to Sigsbee Scarp. Sigsbee Scarp is interpreted as the front of a system of diapiric uplifts and ridges having salt cores. The ridges may have helped in building the continental border by trapping sediments. Sigsbee knolls and domes are not associated with continental-margin growth.—S.P.S.

Ewing, Maurice. *See* Conolly, John R. 3949

Ewing, Maurice. *See* Saito, Tsunemasa. 4310

4168 **Ezell, Paul; Moriarty, James R.; Mudie, John D.; Rees, Antony L.** Magnetic prospecting in southern California: Am. Antiquity, v. 31, no. 1, p. 112–113, 1965.

A proton magnetometer survey of a site near San Diego, Calif., revealed two hearths and a fire pit which otherwise would not have been discovered without extensive excavation. Further use of magnetic surveying for archeological purposes in North America is warranted.—D.B.V.

Fahey, J. J. *See* Stewart, D. B. 4330

3955 **Fairbridge, Rhodes W.** Diagenetic phases [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 612–613, 1966.

4200 **Fallaw, Wallace Craft.** The Pleistocene Neuse Formation in southeastern North Carolina [abs.]: Dissert. Abs., v. 26, no. 7, p. 3860–3861, 1966.

4201 **Fanale, Fraser Partington.** Helium in magnetite [abs.]: Dissert. Abs., v. 26, no. 7, p. 3861, 1966.

4278 **Feininger, Tomas.** Bedrock geologic map of the Voluntown quadrangle, New London County, Connecticut, and Kent and Washington Counties, Rhode Island: U.S. Geol. Survey Geol. Quad. Map GQ–436, scale 1:24,000, sections, separate text, 1965.

Glacial deposits of Wisconsin age—ground moraine, stratified glaciofluvial sand, silt, and gravel, and proglacial lake clay—constitute the bulk of the surficial sediments of the Voluntown quadrangle. Most of the glaciofluvial sediments were deposited during four episodes of deglaciation. Postglacial sediment is restricted to thin swamp deposits. Economic resources are ground water, sand and gravel, and clay.

Fenwick, K. G. *See* Pye, E. G. 4319

4019 **Ferrians, Oscar J., Jr.; Nichols, Donald R.** Resume of Quaternary geology of the Copper River basin, *in* Guidebook for Field Conference F, Central and south central Alaska—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 93–114, illus., 1965.

The Copper River basin is rimmed by high peaks of the Alaska Range and the Talkeetna, Chugach, and Wrangell Mountains. The bordering rocks, middle Paleozoic to Tertiary in age, consist of metamorphosed and unaltered sediments, tuffaceous beds and basalt flows, and igneous intrusions. In the southeastern part of the basin, thin andesite flows are interbedded with Pleistocene deposits. Several glaciations from the surrounding mountains accumulated in the center of the basin and were drained by radial flow. With each stage an extensive proglacial lake was formed, which accounts for lack of end moraines and associated features in the lower part of the basin. Complicated interfingering of lacustrine and glacial deposits and numerous shoreline features indicate wide fluctuation of lake level before its drainage 9,000 years ago. Today muskegs and marshes are perched on permafrost lake sediments. A measured Copper River bluff section of 300 feet is described.—G.D.C.

Ford, A. B. *See* Crowder, D. F. 4273

4202 **Ford, John Philip.** Bedrock geology in southwest Hamilton County, Ohio [abs.]: Dissert. Abs., v. 26, no. 7, p. 3861–3862, 1966.

4031 **Forgotson, James M.** Biodepositional or reefoid?: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 580, 1966.

The term "biodepositional", meaning deposited by living organisms, should replace "reefal" and "reefoid".—W.C.C.

3899 **Forgotson, James M., Jr.; Statler, Anthony T.; David, Marthann.** Influence of regional tectonics and local structure on deposition of Morrow Formation in western Anadarko Basin: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 518–532, illus., 1966.

The Morrow Formation is the basal, transgressive, predominantly clastic unit of the Pennsylvanian System and unconformably overlies Mississippian. The formation is subdivided into three distinct units. The lower is predominantly terrigenous and is overlapped by the relatively calcareous middle unit. The upper is a predominantly marine and lagoonal shale that grades upward into non-marine shale and coal. Underlying Chester rocks are locally absent and distribution of sand bodies in the Morrow suggest movement prior or during deposition of the initial Pennsylvanian sediments and subsequent filling of the basin. A clastic source area is suggested west and northwest of the Panhandle area and another probably was northeast.—E.K.M.

4070 **Forman, J. A.** Diving geology [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 647, 1966.

Forsyth, Jane L. *See* Goldthwait, Richard P. 4149

3956 **Fowler, Gerald A.** Foraminiferal paleoecology of upper Miocene Montesano Formation, western Washington [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 613, 1966.

4071 **Fowler, Gerald A.** Stratigraphy of Montesano Formation, Washington [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 647, 1966.

Fowler, William A. *See* Burnett, D. S. 4040

3957 **Fray, Charles T.** Relations among shear strength, physical, and acoustical properties of sediment cores from eastern Pacific [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 613–614, 1966.

Freeman, Joan E. *See* Black, Robert F. 4143

4180 **Freeman, Tom.** Paleozoic analogues of Recent carbonates: Arkansas Acad. Sci. Proc., v. 19, p. 79–80, 1965.

Examples of analogs of Recent carbonates are drawn from the Joachim Limestone (Ordovician), the Pitkin Limestone (Mississippian), the Plattin Limestone (Ordovician), and the Fayetteville Shale (Mississippian) of northern Arkansas.—E.S.L.

Frey, Fred A. *See* Haskin, Larry A. 4038

Fricker, Peter E. *See* Reynolds, Ray T. 3995

3958 **Friedman, Gerald M.** Porosity changes during lithification from unconsolidated carbonate sediment to consolidated limestone [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 614, 1966.

4139 **Froelich, Larry L.** Lansford water supply survey, Bottineau County, North Dakota: North Dakota Water Comm. North Dakota Ground-Water Study 64, 32 p., illus., tables, 1966.

The Tertiary Cannonball Formation underlies the entire Lansford area; although its total thickness is not definitely known, it is at least 207 feet thick, and consists for the most part of fine-grained sandstone. Wells in the Cannonball produce sufficient water for ordinary domestic and livestock demands, but it is undesirable for municipal water supply. Wells in the Tongue River Formation yield about 5–10 gpm due to fine-grained nature of the sediments and poor hydrologic connections.

Till, the greatest part of glacial drift in the area, consists essentially of clay and silt and is too fine-grained to yield water readily to wells. Water from bedrock formations is chemically undesirable; aquifers associated with till are usually confined, subject to dewatering, and water is highly mineralized and very hard. Recommendations are that surface water be utilized for a municipal supply. M.C.M.

Frye, J. C. *See* Swann, David H. 4058

4144 **Frye, John C.; Willman, H. B.** The Illinois Quaternary, *in* Guidebook for Field Conference C, Upper Mississippi Valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 81–110, illus., table, 1965.

Illinois has representative deposits of each stage of the Pleistocene. It is the type region for the Illinoian Stage and its three substages and for the Sangamon Stage, and contains parts of Wisconsinan type areas. A unique overlap in central and western Illinois is the result of glaciers from two separate dispersal centers—one west of Hudson Bay and the other eastern Canada. Five diverse source areas are distinguished by contrasting mineral assemblages of the several drifts. The stratigraphy is described with measured sections, classifications of the Pleistocene series and the Wisconsin stage used in Illinois are given, and various geomorphic features are identified.—G.D.C.

4146 **Frye, John C.; Willman, H. B.** Illinois, *in* Guidebook for Field Conference G, Great Lakes–Ohio River valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 5–26, illus., table, 1965.

During the past decade, the Pleistocene correlation and classification in Illinois have been extensively modified; those currently in use are shown here. A number of measured sections to be seen are described, and a table of analyses of heavy and clay minerals is given. Silurian reefs project through glacial drift and deposits of glacial Lake Chicago. The Glenwood stage of this Lake is carbon dated between 1200 and 1400 years B.P. In addition to being the type region for the Illinoian Stage, this state has representative deposits of the Sangamon and Wisconsin Stages.—G.D.C.

Fryxell, Roald. *See* Richmond, G. M. 3918

3919 **Fryxell, Roald; Richmond, G. M.; Malde, H. E.; Trimble, D. E.; Bright, R. C.; Rubin, Meyer.** The canyons of western Idaho, the Snake River Plain, and the Bonneville flood, Pt. G *in* Guidebook for Field Conference E, Northern and Middle Rocky Mountains—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 90–104, illus., table, 1965.

Observations made along the conference route, on the Quaternary in the mountains and canyons of western Idaho, are based on reconnaissance. The Snake River Plain is a broad structural trough of Pliocene and Pleistocene basalt and sediment, cut successively by a series of canyons filled by subsequent basaltic eruptions. The present canyon is the last of this series, and the eastern Snake River Plain is largely covered with late Pleistocene and Recent basalt. The effects of a late Pleistocene flood of catastrophic proportions which had its source in the Bonneville Basin are seen on this trip.—G.D.C.

Fryxell, Roald. *See* Richmond, G. M. 4027

4030 **Fuller, M. D.; Harrison, C. G. A.; Nayudu, Y. R.** Magnetic and petrologic studies of sediment found above basalt in experimental Mohole core EM7: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 566–573, illus., table, 1966.

The magnetism of the sediments suggests different sources for the upper and lower parts, and suggests that the basalt intruded the sediment.—W.C.C.

4306 **Furnish, W. M.; Knapp, W. D.** Lower Pennsylvanian fauna from eastern Kentucky—Pt. 1, Ammonoids: Jour. Paleontology, v. 40, no. 2, p. 296–308, illus., tables, 1966.

New collections of Pottsvillean goniatites from the eastern Kentucky coalfield area show a close resemblance to those of the southern Mid-continent. The most important form for age assignment is an upper Morrowan element, *Diabloceras neumeieri* Quinn and Carr, 1963. *Gastrioceras occidentale* (Miller and Faber, 1892), the most common species in the Kentucky fauna, is comparable to forms from Arkansas and Oklahoma. Also, *Dimorphoceratoides campbellae* n. gen. et sp. can be related to a known phylogenetic sequence elsewhere.—Authors' abstract

3913 **Gaede, Verne F.** La Habra area of Whittier oil field: California Div. Oil and Gas, California Oil Fields—Summ. Operations, v. 51, no. 1, p. 53–59, illus., tables, 1965.

Structure within the La Habra area consists of two types separated by the Escondido fault. South of the fault the structure appears to be basically anticlinal; north of the fault the structure is a homocline with beds dipping 40° to the north. The Repetto (lower Pliocene) and Puente (upper Miocene) are the only formations that have been penetrated to date. The deepest well was still in Miocene sediments at a total depth of 7,289 feet.—M.C.M.

4203 **Gale, Robert Earle.** The geology of Mission copper mine, Pima mining district, Arizona [abs.]: Dissert. Abs., v. 26, no. 7, p. 3862–3863, 1966.

Gard, J. A. *See* Carpenter, A. B. 4291

4183 **Garner, H. F.** Base-level control of erosion surfaces: Arkansas Acad. Sci. Proc., v. 19, p. 98–104, illus., 1965.

The control of erosion surfaces by base level has gone unquestioned in the literature for many decades. If alternative interpretations are possible, they should certainly be noted because they bear on major concepts. Two aspects of the problem, the nature of any control mechanism and the character of alternative reference datums, are discussed. The three principal theories of erosion-surface genesis, Davis' peneplanation theory, King's pediplanation theory, and the planation-aggradation theory of Quinn are reviewed. Garner would replace regional base level as a leveling datum with atmospheric zonation.—E.S.L.

Garrels, Robert M. *See* Mackenzie, Fred T. 3980

3959 **Gartner, Stefan, Jr.** Nannofossils from Upper Cretaceous of Texas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 614, 1966.

4279 **Gaskill, David L.; Godwin, Larry H.** Geologic map of the Marble quadrangle, Gunnison and Pitkin Counties, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-512, scale 1:24,000, sections, text, 1966.

In the Marble quadrangle seven or more coal beds up to four feet thick crop out in the lower 900 feet of the Mesaverde Formation; about 7,000 tons of high volatile bituminous and anthracite coal have been mined and estimated reserves total about 30 millon tons. Approximately 1 1/2 million tons of marble have been produced from the Yule quarries in recrystallized Leadville Limestone on Yule Creek; other thick marble beds in lower Paleozoic and Pennsylvanian formations may have future commercial value. Zinc, lead, copper, silver, and iron sulfide deposits associated with the northwest-trending system of faults and fissure veins cutting the Treasure Mountain dome have been worked intermittently. Due to large igneous intrusions, local metamorphism, and truncation of the sedimentary rocks around the Treasure Mountain dome, the prospect of oil and gas production is small.—M.C.M.

4280 **Gaskill, David L.; Godwin, Larry H.** Geologic map of the Marcellina Mountain quadrangle, Gunnison County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-511, scale 1:24,000, section, text, 1966.

In areas adjacent to the Marcellina Mountain quadrangle, beds of high volatile B bituminous coal are present in the lower part of the Mesaverde Formation. Equivalent coal beds probably underlie parts of the map-area but because of deep burial, intrusion of large laccolithic bodies, and availability of large accessible reserves in adjoining coal fields, they are not of present economic importance. Hydrothermal mineralization is localized along the eastern border where fissure veins carrying disseminated zinc, lead, copper, and silver minerals are associated with the intrusive complex of the Ruby Range, but prospects for production are negligible. Owing to intrusion of large igneous structures and associated metamorphism, prospects for oil or gas production are marginal.—M.C.M.

4072 **Gastil, Gordon; Allison, Edwin C.** An Upper Cretaceous fault-line coast [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 647–648, 1966.

4073 **Gerard, Robert.** J.O.I.D.E.S. ocean drilling on continental margin off Florida [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 648, 1966.

Gibbons, A. B. *See* Sargent, K. A. 4331

4164 **Gibson, Lee B.** Foraminiferal species diversity distributions, eastern Gulf of Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 614–615, 1966.

4140 **Gillespie, J. B.; Bentley, C. B.; Kam, William.** Basic hydrologic data of the Hualapai, Sacramento, and Big Sandy Valleys, Mohave County, Arizona: Arizona Land Dept. Water-Resources Rept. 26, 39 p., illus., tables, 1966.

Included in this report are records of water wells and springs, drillers' logs that describe the materials encountered during well drilling, chemical analyses of water, well-locations maps, water-table contour maps, and hydrographs of water levels in wells.—M.C.M.

4204 **Gimlett, James Irwin.** The gravimetric method applied to basin exploration, exemplified by a study of Warm Springs Valley, Washoe County, Nevada [abs.]: Dissert. Abs., v. 26, no. 7, p. 3863, 1966.

Gittens, J. *See* Macintyre, R. M. 4258

3906 **Godby, E. A.; Baker, R. C.; Bower, M. E.; Hood, P. J.** Aeromagnetic reconnaissance of the Labrador Sea: Jour. Geophys. Research, v. 71, no. 2, p. 511–517, illus., 1966.

Data of 12 low-level aeromagnetic profiles across the Labrador Sea are presented in the form of profiles with the regional gradient removed. There is good correlation between anomalies on adjacent flight lines in a number of places, and the area may be divided into two zones having anomalous magnetic signatures. These zones can be followed through the central part of the Labrador Sea and are generally flanked by areas of lesser magnetic relief. The more westerly zone strikes toward Hudson Strait and appears to die out about lat 59° N. The presence of the magnetic zones, marine seismic results, and the fact that five earthquakes are known to have occurred in the area between the zones suggest the existence of an active buried median ridge.—D.B.V.

Godwin, Larry H. *See* Gaskill, David L. 4279

Godwin, Larry H. *See* Gaskill, David L. 4280

4149 **Goldthwait, Richard P.; Forsyth, Jane L.; White, George W.** Ohio, *in* Guidebook for Field Conference G, Great Lakes–Ohio River valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 64–90, illus., tables, 1965.

In the southernmost extension of Quaternary ice in Ohio, each advance was split by the topography into two long lobes—the Miami (visited in Indiana) and Scioto—and two stubby lobes—the Killbuck and Grand Valley (not visited). With the last

retreat these lobes resolved northward into the Erie Lobe, the Wabash Moraine. The drifts of different ages are identified by improved stratigraphic treatment, classical examples of the deposits and drainage changes are visited, and several measured sections are presented. Also seen are the ancient beaches of glacial lake levels in the Cleveland area.—G.D.C.

Good, J. M. *See* Love, J. D. 4028

Goode, H. D. *See* Bright, R. C. 4026

3960 **Goodell, H. Grant.** Early diagenesis and mass properties of siliceous oozes [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 615, 1966.

Gooding, A. M. *See* Wayne, William J. 4147

3961 **Gordon, Mackenzie, Jr.** Local and interregional distribution of late Paleozoic cephalopods [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 615, 1966.

4309 **Gordon, Mackenzie, Jr.** Classification of Mississippian coleoid cephalopods: Jour. Paleontology, v. 40, no. 2, p. 449–452, illus., 1966.

The purpose of this short paper is to reassess the Mississippian coleoids in the light of Jeletsky's (1965) new classification, and to assign each genus to its proper place in the hierarchy.—Author's resumé

4135 **Gould, H. R.; Morgan, J. P.** Coastal Louisiana swamps and marshlands, *reprinted in* Guidebook for Field Conference B–3, Mississippi Delta and Central Gulf Coast—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 30–72, illus., 1965; originally published 1962.

The swamps and marshes of coastal Louisiana include the 200-mile wide deltaic plain of the Mississippi River and the 100-mile wide chenier plain in the southwestern part of the State, a total area of 14,000 sq mi. This trip observes environments in which peat accumulates, and sedimentary and geomorphic features of active and abandoned river courses and their distributaries and progradation. Also included are visits to the Avery Island salt dome, and to the Pleistocene Prairie terrace to view relict Mississippi River scars.—G.D.C.

4231 **Grant, F. S.; Martin, Luciano.** Interpretation of aeromagnetic anomalies by the use of characteristic curves: Geophysics, v. 31, no. 1, p. 135–148, illus., 1966.

In fitting simple models such as prisms or tabular bodies to magnetic anomaly patterns, certain dimensionless groupings of measurements from the anomaly—termed "characteristic estimators"—appear to be more effective than others in achieving satisfactory solutions. *Characteristic curves* are a concise, graphical presentation of the behavior of characteristic estimators with changes in the parameters of the model, and are convenient for making rapid interpretations of anomalies. In this paper, illustrations of characteristic curves are given for the prism and for the tabular body, together with illustrations of their use from field examples.—Authors' abstract

4086 **Greene, Gordon W.** Tiltmeter measurements, *in* General geology of Death Valley, California—Stratigraphy and structure: U.S. Geol. Survey Prof. Paper 494-A, p. A112–A114, illus., 1966.

Tiltmeter observations at seven stations in Death Valley, Calif., show that ground surfaces are being tilted in a direction consistent with the structural geology and tend to follow the present dip of strata at each station. An average rate of 0.9 microradian per month is common for the area but the actual rate varies widely from station to station. There is no evidence that tilting is related to any single or series of events. Death Valley is a relatively aseismic area but there may be some relationship between tilting movements there and earthquakes with epicenters about 50 miles away.—V.S.N.

4109 **Greene, Herbert G.; Conrey, Bert L.** Seismic investigation of Eel Submarine Canyon, Humboldt County, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 648, 1966.

Greenland, D. J. *See* Williams, B. G. 3889

Gross, G. A. *See* Sangster, D. F. 3927

Gryc, George. *See* Lathram, Ernest H. 3973

Gzovsky, M. V. *See* Belousov, V. V. 4190

4294 **Haan, C. T.; Johnson, H. P.** Rapid determination of hypsometric curves: Geol. Soc. America Bull., v. 77, no. 1, p. 123–125, illus., 1966.

This paper describes a simple and rapid method, based on a random sampling technique, for obtaining hypsometric curves of basins. The method may be employed to any desired precision, and, when it is compared with conventional methods, it reduces the time for obtaining the curves by a factor of from four to ten. The technique may be used for measuring most basin properties that involve areal measurements.—Authors' abstract

4052 **Hack, John T.** Geology of the Brandywine area and origin of the upland of southern Maryland [abs.], *reprinted in part in* Guidebook for Field Conference B–1, Central Atlantic Coastal Plain—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 25–26, illus., 1965; originally published 1955.

4205 **Hamric, Burt Ervin.** Petrology and trace element geochemistry of the DeQueen Formation (Cretaceous), southwest Arkansas [abs.]: Dissert. Abs., v. 26, no. 7, p. 3863–3864, 1966.

4313 **Hansen, Arnold J., Jr.** Availability of ground water in the Crutchfield quadrangle, Jackson Purchase region, Kentucky–Tennessee: U.S. Geol. Survey Hydrol. Inv. Atlas HA–167, scale 1:24,000, sections, text, 1966.

The principal aquifer in the Crutchfield quadrangle is Eocene sand in which properly constructed wells may yield more than 1,000 gpm. The quality of water in the main zone of saturation is satisfactory for most uses. The map sheet includes a generalized columnar section and water-bearing characteristics of the geologic formations, a generalized geologic section through Union Cumberland Church and Bellerton, and a table showing iron content and pH of the water.—M.C.M.

Harbaugh, John W. *See* Merriam, Daniel F. 3984

Harding, James L. *See* Bryant, William R. 3945

3908 **Hardoin, John L.** Railroad Gap oil field: California Div. Oil and Gas, California Oil Fields—Summ. Operations, v. 51, no. 1, p. 5–12, illus., tables, 1965.

The deepest well in the Railroad Gap oil field was drilled to a depth of 12,371 feet and encountered sedimentary rocks representing each geologic series from Pleistocene to Eocene. Structure of the field is en echelon relative to folds of nearby fields. Producing zones are described and in pocket are contour maps, composite electric log and stratigraphic column, and cross sections.—M.C.M.

Harrison, C. G. A. *See* Fuller, M. D. 4030

4171 **Hartshorn, J. H.; Schafer, J. P.** New England, Pt. 1 *in* Guidebook for Field Conference A, New England–New York State—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 5–38, illus., 1965.

The Quaternary phenomena included in this part of Conference A (southern New England and Mt. Washington, N. H.) are principally the effects of the last

glaciation—moraines, glacial-lake and marine deposits, complex glaciofluvial deposits, and periglacial features. A widespread older drift, well exposed in drumlins, is possibly of post-Sangamon age, particularly that part of a stratigraphic section on Martha's Vineyard where effects of ice thrust deformation are displayed.—G.D.C.

Hartshorn, Joseph H. *See* Zen, E-an. 4333

4038 **Haskin, Larry A.; Frey, Fred A.** Discussion of paper by J. W. Morgan and J. F. Lovering [1965], "Uranium and thorium abundances in the basalt cored in Mohole project (Guadalupe site)": Jour. Geophys. Research, v. 71, no. 2, p. 688-689, 1966.

In a previous paper, Frey and Haskin (1964) claimed nothing more for the experimental Mohole and Atlantic ridge basalts than that their *rare-earth patterns* were "decidedly primitive"; they did not use the similarity between the basalt and the chondritic rare-earth patterns as evidence for a "decidedly primitive" nature of the magmas which gave rise to these basalts, as Morgan and Lovering (1965) have claimed they did. "Primitive" as applied to the basalt rare-earth patterns was intended to mean closely similar to the primordial element distribution as inferred from the chondritic distribution. It is true that the Th/U ratio for the Mohole basalt is not the same as those reported for chondrites.—D.B.V.

4206 **Hay, Peter William.** The stability and occurrence of cordierite in selected gneisses from the Canadian Shield [abs.]: Dissert. Abs., v. 26, no. 7, p. 3864, 1966.

Haynes, C. V. *See* Denson, N. M. 3916

3905 **Hays, Walter W.; Scharon, LeRoy.** A paleomagnetic investigation of some of the Precambrian igneous rocks of southeast Missouri: Jour. Geophys. Research, v. 71, no. 2, p. 553-560, illus., table, 1966.

Measurements of the magnetic susceptibility and intensity of direction of remanent magnetization were made on 325 cores from 189 samples of felsites, granites, and diabases from southeast Missouri. The results show that the directions of magnetization, although variable, are significantly different from that of the present geomagnetic field. A-c partial demagnetization greatly improves the scatter of the remanent magnetization vector. The paleomagnetic data from five rock units indicate a Precambrian pole in the vicinity of long 150° W., lat 5° N.—D.B.V.

4110 **Heintz, Louis O.** Seasonal distribution of magnetite and ilmenite in beach sand of Malaga Cove, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 648, 1966.

Heizer, R. F. *See* Bennyhoff, J. A. 4083

4163 **Henbest, Lloyd G.** Date of silicification and relative strengths of biogenic calcite in plastically deformed Permian limestone, Ubehebe Peak area, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 617, 1966.

4225 **Henderson, Garry Couch.** Computer analysis techniques applied to crustal studies of Campeche Bank, Mexico [abs.]: Dissert. Abs., v. 26, no. 7, p. 3997, 1966.

3901 **Henningsen, Dierk.** Notes on stratigraphy and paleontology of Upper Cretaceous and Tertiary sediments in southern Costa Rica: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 562-566, illus., tables, 1966.

Sedimentary rocks in southern Costa Rica range in age from Late Cretaceous to Pliocene, and consist of limestone, arenite, black shale conglomerate, lava flows, pyroclastics, and andesitic, basaltic, and gabbro-basaltic intrusives. Many beds contain Foraminifera. Large volcanic islands in the Pacific are postulated as the source of sediments deposited toward the north.—W.C.C.

Herrington, H. B. *See* Zoltai, S. C. 4307

Hesse, Reinhard. *See* VonRad, Ulrich. 4121

4260 **Hessler, V. P.** On a floating island: Science, v. 151, no. 3716, p. 1360–1362, illus., 1966.

Seven U.S. Arctic drifting stations have been in operation for varying periods since the establishment of the IGY station Alpha I in 1957. The second was Station Charlie, and the third was T–3, also known as Fletcher's Ice Island. Since September 1960 four additional drifting stations have been established—Arctic Research Laboratory Ice Stations ("Arlis") I, II, III, and IV. The last two were temporary small stations set up on the pack ice about 150 miles northeast of Point Barrow to study telluric currents, geomagnetic activity, and auroras, and also for oceanographic studies. A number of photographs taken on Arlis IV in March and April 1965 are presented, with explanatory text.—D.B.V.

3998 **Heymann, Dieter; Lipschutz, Michael E.; Nielsen, Betty; Anders, Edward.** Canyon Diablo meteorite—Metallographic and mass spectrometric study of 56 fragments: Jour. Geophys. Research, v. 71, no. 2, p. 619–641, illus., table, 1966.

The history of the Canyon Diablo fragments is reconstructed on the basis of study of 56 specimens by metallography and mass spectrometry and of 5 by metallography only. Rim (and diamond-bearing) specimens have been much more strongly reheated than plains specimens. According to the He–3 content the great majority came from the outermost 2 m of the meteoroid. There appears to be distinct grading of shock effects with depth. The throwout pattern for shocked material seems to have been highly directional, like the lunar ray craters. Measurements of He, Ne, and Ar in 14 samples gave cosmic ray ages that indicate that the Canyon Diablo object apparently originated in a breakup 540 m.y. ago and suffered a secondary collision 170 m.y. ago.—D.B.V.

3965 **Hiestand, Thomas C.** Petroleum migration and accumulation—Paleohydrogeologic concept [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 617, 1966.

3911 **Hill, F. L.** Kettleman Middle Dome oil field: California Div. Oil and Gas, California Oil Fields—Summ. Operations, v. 51, no. 1, p. 39–46, illus., tables, 1965.

Formations encountered in the Kettleman Middle Dome area range in age from Quaternary alluvium to Eocene; a table shows the general stratigraphy of the area and the lithologic characteristics of the various formations penetrated. The Coalinga anticline, which is said to have its inception in the Franciscan Formation of the complex mountainous area northwest of the City of Coalinga, continues to the south and has resulted in the formation of an en echelon series of asymmetrical anticlinal structures or elongated domes including Kettleman North, Middle and South Domes. Middle Dome is the lowest structurally and smallest in areal extent, with a closure of approximately 600 feet. Current production in the field is from sands and fractured shales of the Kreyenhagen Formation (Oligocene and Eocene).—M.C.M.

Hoffard, Stuart H. *See* Ward, Porter E. 4089

4011 **Hofman, H. J.; Parsley, R. L.** Antennae of *Ogygopsis*: Jour. Paleontology, v. 40, no. 1, p. 209–211, illus., 1966.

Two specimens of the Middle Cambrian trilobite *Ogygopsis klotzi* (Rominger) from the Stephen Formation, Mount Stephen, British Columbia, bear imprints of what appear to be antennae protruding from the anterior of the cephalon; they seem to originate beneath the cephalon.—R.E.G.

Holden, John C. *See* Dietz, Robert S. 3936

Holden, John C. *See* Dietz, Robert S. 4106

Hole, Francis D. *See* Black, Robert F. 4143

4250 **Holloway, Harold D.** Investigation of ground-water contamination, Rhineland area, Knox County, Texas: Texas Water Comm. Bull. 6521, 39 p., illus., tables, 1965.

Rocks of Permian age and overlying unconsolidated sediments of Quaternary age are exposed at the surface in the Rhineland area in west-central Texas. The sediments belong principally to the Seymour Formation, which together with hydrologically connected Recent deposits, form the principal aquifer. Permian rocks belong to the Vale Formation of the Clear Fork Group and consist of shale, thin beds of gypsum and dolomite, and some sandstone. Depth to water in the Seymour ranges from about 10 to 30 feet and saturated thickness of the formation is from 10 to 20 feet. Water is very hard and can be classified as sodium bicarbonate. Contamination from sewage, ABS, and coliform bacteria lead to recommendations that a public water supply be developed and that individual wells be punched or drilled, rather than dug.—*from* Author's abstract

Holmer, R. C. *See* Strangway, D. W. 4236

4329 **Holser, W. T.** Diagenetic polyhalite in Recent salt from Baja California: Am. Mineralogist, v. 51, nos. 1–2, p. 99–109, illus., table, 1966.

Halite and gypsum now being deposited on extensive tidal flats at Laguna Ojo de Liebre, Baja California, are underlain by up to two meters of bedded evaporites. The porous evaporite sediments are permeated by bitterns whose stage of evaporation increases with distance from the lagoon. Beyond 4 to 8 km from the lagoon, gypsum crystals in the sediments have been altered to fine grained polyhalite, by a bittern nearly in the potash magnesia facies (concentration 60X sea water). Although older polyhalite has occasionally been described as a primary precipitate, this modern occurrence confirms other geological and experimental evidence that polyhalite can replace calcium sulfate and that this can occur at an early diagenetic stage.—Author's abstract

Hood, P. J. *See* Godby, E. A. 3906

Hood, P. J. *See* Sangster, D. F. 3927

Hoover, D. L. *See* Sargent, K. A. 4331

4062 **Horn, M. K.; Adams, J. A. S.** Computer-derived geochemical balances and elementary abundances: Geochim. et Cosmochim. Acta, v. 30, no. 3, p. 279–297, illus., tables, 1966.

The classical geochemical equation or balance, which assumes that all sediments were ultimately derived from igneous rocks, provides a number of internal checks on elemental and isotopic abundance data. A new computer approach to geochemical balancing is described here which yields calculations of total mass of weathered igneous rock mass distribution of elements within the geological and marine domains, a list of elements that could not be balanced, and elemental abundance tables derived automatically from the optimized model.—D.B.V.

3966 **Hoskin, Charles M.** Coral pinnacle sedimentation, Alacrán Reef Lagoon, Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 617, 1966.

4292 **Hostetler, P. B.; Coleman, R. G.; Mumpton, F. A.; Evans, B. W.** Brucite in Alpine serpentinites: Am. Mineralogist, v. 51, nos. 1–2, p. 75–98, illus., table, 1966.

X-ray diffraction of 102 Alpine-type ultramafic rocks indicates that brucite (up to 10 weight percent) commonly forms during serpentinization of dunites and high-olivine peridotites, and indicates maximum temperatures of about 400°C. As field evidence does not support the loss of massive amounts of magnesia and silica, the presence of brucite requires volume increases of 35 to 40 percent due to serpentinization. The tectonic environment of Alpine ultramafics suggests that such large volume changes are not in situ, but result from incremental additions of water during the tectonic ascent of the ultramafic mass through the Earth's crust.

Alteration of brucite to magnesite, hydromagnesite, artinite, pyroaurite and coalingite is described.—B.C.H.

3967 **Howard, James D.** Nearshore depositional environments of Upper Cretaceous Panther Tongue, east-central Utah [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 618, 1966.

Howard, R. H. *See* Bristol, H. M. 4131

3892 **Howe, Herbert J.** Morphology of the brachiopod genera *Rhynchotrema*, *Hypsiptycha*, and *Lepidocyclus*: Jour. Paleontology, v. 39, no. 6, p. 1125–1128, illus., 1965.

On the basis of large collections from the Montoya Group of western Texas, the Maquoketa Shale of Iowa and Minnesota, and the Richmond Group of Ohio and Indiana (all Ordovician), definitions of these three brachiopod genera are emended to permit morphologic overlap. All have well developed teeth located near the lateral edge of the hinge line, elongate sockets, triangular hinge plates, high blade-like cardinal processes, and flabellate ventral muscle patterns. The value of dental plates for generic discrimination among these three genera is questioned; the cruralium is variable; the strength of the fold, and the lateral outline are useful only on the specific level.—R.E.G.

4305 **Howe, Herbert J.** Orthacea from the Montoya Group (Ordovician) of trans-Pecos Texas: Jour. Paleontology, v. 40, no. 2, p. 241–257, illus., tables, 1966.

Orthacea in the Upham, Aleman, and Cutter formations include *Glyptorthis insulpta maquoketensis* Ladd, *Hesperorthis kirki* n. sp., *Plaesiomys bellistriatus* Wang, *P.* cf. *P. subquadratus* (Hall), *P. subquadratus cutterensis* n. subsp., *Hebertella occidentalis montoyensis* n. subsp., *Austinella kankakensis* (McChesney), *Platystrophia prayi* n. sp., and an unnamed species of *Platystrophia*. Comparison of muscle scar patterns in *Plaesiomys* shows difficulty of basing specific differentiation upon pedicle valve musculature; number of costae per unit distance along the anterior margin, when correlated with shell size, proves to be more reliable. The Aleman and Cutter are correlated with the Maquoketa Shale of Iowa (Cincinnatian).—R.E.G.

4339 **Howe, Herbert J.** The brachiopod genus *Lepidocyclus* from the Cape (Fernvale) Limestone (Ordovician) of Oklahoma and Missouri: Jour. Paleontology, v. 40, no. 2, p. 258–268, illus., tables, 1966.

Three species of *Lepidocyclus* Wang are described from the Cape Limestone of Missouri and the "Fernvale" Limestone of Oklahoma. Two species are new: *L. cooperi* from Oklahoma and *L. oblongus* from Missouri.—Author's abstract

4010 **Howell, B. F.** New Upper Cretaceous sponge from Puerto Rico: Jour. Paleontology, v. 40, no. 1, p. 207–209, illus., 1966.

Callopegma pessagnoi n. sp. occurs in the Sabana Hoyos Limestone Member of the Cariblanco Formation (upper Santonian or lower Campanian). Hitherto this genus was known only in Europe.—R.E.G.

Hoyle, Fred. *See* Burnett, D. S. 4040

4111 **Hsu, K. Jinghwa.** Structural evolution of Santa Lucia Range, California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 648–649, 1966.

4340 **Huber, N. King; Rinehart, C. Dean.** Some relationships between the refractive index of fused glass beads and the petrologic affinity of volcanic rock suites: Geol. Soc. America Bull., v. 77, no. 1, p. 101–109, illus., 1966.

A study of relationships between silica content and refractive index of glass beads fused from an alkalic-calcic suite of volcanic rocks from the Mammoth Lakes region of the eastern Sierra Nevada of California, a calc-alkalic suite from the western Cascades of Oregon, and an intermediate suite from Lake County, Oreg., shows that the relationships may vary appreciably from one petrologic suite to another.

Although an "average" silica refractive-index curve is useful for estimating the approximate silica content of volcanic rocks, separate curves differ enough between volcanic suites of different petrologic affinities to warrant construction of individual curves in order to obtain maximum accuracy when using the method.—H.C.W.

4084 **Hunt, Charles B.; Robinson, T. W.; Bowles, Walter A.; Washburn, A. L.** General geology of Death Valley, California—Hydrologic basin: U.S. Geol. Survey Prof. Paper 494-B, p. B1-B138, illus., tables, geol. map, 1966.

The Death Valley hydrologic basin covers 8,700 sq mi of which 500 sq mi is below sea level. Of this, 200 sq mi is saltpan mostly between 270 and 282 feet below sea level. Ground water in Death Valley is partly or largely derived from neighboring basins and enters the valley along faults. At the center of the saltpan the salts and brines are chlorides. Around this is a zone with sulfate salts. Carbonates occur in a zone around the edge of the pan. The salts are zoned also with respect to their degree of hydration; the lesser hydrates occur on dry surfaces where temperatures are high and on wet surfaces having much sodium chloride. Patterned ground in the salt formations is similar to that in arctic regions.—C.B.H.

4085 **Hunt, Charles B.; Mabey, Don R.** General geology of Death Valley, California—Stratigraphy and structure: U.S. Geol. Survey Prof. Paper 494-A, p. A1-A165, illus., tables, geol. map, 1966.

Rocks exposed in Death Valley aggregate more than 60,000 feet thick and include Precambrian metamorphic and igneous rocks, late Precambrian sedimentary rocks, Paleozoic sedimentary rocks of all periods of that era, Triassic formations, Cenozoic volcanic and sedimentary rocks and granitic intrusions. The Paleozoic and late Precambrian formations occur in thrust plates of the Amagosa thrust system, which moved younger rocks westward over older ones. Granitic intrusions spread along the thrust faults doming the upper plates. As folding and faulting continued, the magmas erupted and slabs of the upper thrust plates moved as detachment blocks into the basins. This continued during the subsequent stage of block faulting that produced Death Valley in late Pliocene and Quaternary time. Archeological evidence and tiltmeters show the deformation is continuing.—C.B.H.

4324 **Hunt, Charles B.** Plant ecology of Death Valley, California: U.S. Geol. Survey Prof. Paper 509, 68 p., illus., tables, 1966.

The composition and environment are described of stands of Lower Sonoran plants on and along the foot of gravel fans rising from the edge of the bare saltpan in the interior of Death Valley, and ranging from below sea level to the top of gravel fans and bases of adjoining mountains at 1,000 to 1,500 feet. Plant distribution is closely related to distribution of geologic formations which are more fully described in companion papers (U.S. Geol. Survey Prof. Papers 494-A, B). Illustrations include a map and transect of geology and plants adjacent to the Death Valley saltpan.—V.S.N.

Hurdlow, W. R. *See* Cherry, J. T. 4227

Hutchison, W. W. *See* Baer, A. J. 4276

4325 **Hyde, C.; Landy, R. A.** Whewellite from septarian concretions near Milan, Ohio: Am. Mineralogist, v. 51, nos. 1-2, p. 228-229, tables, 1966.

Crystals of whewellite 3×2×1 inches occur in concretions with calcite, dolomite, and barite. Chemical analyses are given.—M.L.L.

Ingamells, C. O. *See* Donnay, Gabrielle. 4320

4158 **Ingle, James C., Jr.** Pliocene-Miocene boundary in temperate eastern Pacific [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 618-619, 1966.

3887 **Internat. Assoc. Quaternary Research.** Guidebook for Field Conference F, Central and south central Alaska—INQUA, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., 141 p., illus., tables, 1965.

Marine, fluvial, lacustrine, glacial, eolian, and periglacial deposits of Quaternary age are present in these parts of Alaska and are being formed today. Five major areas are considered in this conference and cited individually: the Fairbanks area, central Tanana River area, the Delta River area of the Alaska Range, the Copper River basin, and the Upper Cook Inlet area and Matanuska River valley. The conference first had three days of local field trips out of Fairbanks, then a seven-day trip to Anchorage over the Richardson and Glenn Highways. Compilations were made from references listed in each section and from unpublished information contributed by several individuals.—G.D.C.

3920 **Internat. Assoc. Quaternary Research.** Guidebook for Field Conference E, Northern and Middle Rocky Mountains—INQUA, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., 129 p., illus., tables, 1965.

This guidebook is a narrative description of a route between 4,000 and 5,000 miles long in Colorado, Woming, Montana, Idaho, Washington, Oregon, and Utah. Modern and Pleistocene environments are emphasized. Tertiary history and erosion surfaces, present and past aridity, alpine glaciers, effects of Pleistocene continental glaciation and pluvial floods, tectonic relations, volcanism, C-14 and K-Ar dating, and relict soils are among the features discussed. The trip is organized for two groups; a number of contributors to parts B to I are cited separately.—G.D.C.

4151 **Internat. Assoc. Quaternary Research.** Guidebook for Field Conference G, Great Lakes-Ohio River valley—INQUA, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., 110 p., illus., tables, 1965.

This conference examines the glacial stratigraphy of four states and one province in unconsolidated rock units as they are named, interpreted and correlated by the most recent studies; information was compiled by Richard P. Goldthwait. These have been the classic areas to which most other parts of North America are correlated. The representative deposits of each Pleistocene stage are described for Illinois, Indiana, Kentucky, Ohio, and southern Ontario, which are separately cited to the contributing leaders of those areas.—G.D.C.

4152 **Internat. Assoc. Quaternary Research.** Guidebook for Field Conference H, Southwestern arid lands—INQUA, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., 109 p., illus., tables, 1965.

This 14-day trip begins in Denver with study of Wisconsin glacial and outwash deposits and cirques of the Southern Rocky Mountains province; then the high San Juan Mountains, Quaternary moraines, and prehistoric Mesa Verde National Park. It continues through the southeastern Utah and Arizona desert canyons and mesas and archeological sites of the Navajo Country; the Black Mesa structural basin, Kaibab Plateau, Grand Canyon, Sunset Crater, precipitous south edge of the Colorado Plateau, and the Basin and Range province with Quaternary basin and terrace deposits, and Willcox Playa. In New Mexico are examined features of the Rio Grande Valley, White Sands area, lava flows, Sierra Blanca (southernmost glaciated peak in U.S.A.), and archeological sites and museum; the contrast of plains with mountains is noted on the return to Denver.—G.D.C.

4170 **Internat. Assoc. Quaternary Research.** Guidebook for Field Conference B-1, Central Atlantic Coastal Plain, and Field Conference B-3, Mississippi Delta and Central Gulf Coast—INQUA, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., 117 p., illus., 1965.

The first part of this guidebook was prepared by H. G. Richards, assisted by the several leaders in their areas, separately cited; the itinerary is between New York City and New Orleans. The second part, prepared by J. P. Morgan, includes two separately cited reports which are reprinted from "Geology of the Gulf Coast" and "Guidebook of Excursions, Field Trips 9 and 3" edited by E. H. Rainwater and R. P. Zingula, published by Houston Geological Society (1962). The itinerary ends in Denver, Colo.—G.D.C.

4173 **Internat. Assoc. Quaternary Research.** Guidebook for Field Conference J, Pacific Northwest—INQUA, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., 108 p., illus., tables, 1965.

In few other regions of North America is there preserved as complete or as interesting a record of changing environments as that of the Pleistocene in the Pacific Northwest. Special emphasis is placed on glacial and volcanic phenomena, periglacial features, glaciology, marine and fluvial geomorphology, and mass wasting; and on the variety of climatic zones from the humid Puget Sound and Frazer River lowlands to alpine zones on the high volcanic peaks of Mount St. Helens and Mount Rainier, to semiarid regions east of the Cascade Mountains. The lobes of at least four major glaciations lay close to Pleistocene alpine glaciers; marine drifts and deglaciation features are complex; volcanic activity was vigorously active into historic times; and glacial deposits lie beneath lava flows.—G.D.C.

4174 **Internat. Assoc. Quaternary Research.** Guidebook for Field Conference C, Upper Mississippi Valley—INQUA, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., 126 p., illus., tables, 1965.

The general objective of this conference was to review representative classical Pleistocene localities along a traverse in Nebraska, South Dakota, Minnesota, Wisconsin, Illinois, Iowa, and back to Nebraska. Length of contribution from each state varies according to needs of each leader in addition to the background provided in the INQUA Regional Reports. Typical drift stratigraphy, paleosols, soils, periglacial phenomena, and archaeological sites are included. Contributing authors are individually cited except for Nebraska.—G.D.C.

4179 **Internat. Assoc. Quaternary Research.** Guidebook for Field Conference A, New England–New York State—INQUA, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., 92 p., illus., 1965.

The first part of this trip runs east from New Haven, Conn., to Kingston, R. I., Providence, and the eastern shore of Massachusetts, including the island of Martha's Vineyard; then north to Pinkham Notch in the White Mountains of New Hampshire, returning to Andover, Mass.; then across northern Massachusetts to Amherst. The second part starts here, runs south a little then west to Albany, N. Y., and winds through the Adirondack Mountains to Syracuse, through the Finger Lakes section to Olean, and on to Buffalo and Niagara Falls. The two parts are separately cited to the organizers, J. H. Hartshorn, E. H. Muller, and J. P. Schafer, respectively.—G.D.C.

Irwin, H. T. *See* Denson, N. M. 3916

Irwin-Williams, C. *See* Denson, N. M. 3916

4159 **Jodry, Richard L.** Pore geometry of carbonate rocks [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 619, 1966.

Johnson, H. P. *See* Haan, C. T. 4294

4016 **Johnson, J. G.; Reso, Anthony.** Brachiopods from the Pilot Shale (Devonian) in southeastern Nevada: Jour. Paleontology, v. 40, no. 1, p. 125–129, illus., 1966.

Six brachiopod species including *Syringothyris* sp. are described from the Pilot Shale in the Pahranagat Range of southeastern Nevada. The faunule also contains *Imitoceras* sp. The fossil-bearing beds are concluded to be of late Famennian age.—Authors' abstract

4082 **Johnson, Ralph A.; Stross, F. H.** Laboratory-scale instrumental neutron activation for archaeological analysis: Am. Antiquity, v. 30, no. 3, p. 345–347, illus., table, 1965.

Neutron activation analysis has been used to determine manganese in a series of potsherd chips from sites in the Valley of Mexico. The application of this technique and the use of laboratory-scale commercial equipment is described. Such equipment

can give results in this application that are comparable to those obtained with the much higher fluxes characteristic of large reactors.—Authors' abstract

Johnson, William L. *See* Scholl, David W. 4126

Johnston, G. H. *See* Legget, R. F. 4301

4035 **Jones, David L.** New Upper Cretaceous ammonite, *Protexanites thompsoni*, from California: Jour. Paleontology, v. 40, no. 1, p. 199–203, illus., 1966.

Protexanites thompsoni Jones n. sp. from the Upper Cretaceous Funks Formation of Kirby (1943) in California has an early trituberculate stage and a later quadrituberculate stage, both characteristic of *Protexanites*; however, at a large diameter a pentatuberculate stage characteristic of *Texanites* appears. The suggested geologic age of this new species is late Coniacian or early Santonian.—Author's abstract

4160 **Jones, H. Llewellyn.** Some aspects of sedimentation and paleoecology of Middle Devonian Winnipegosis Formation of Saskatchewan, Canada [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 619–620, 1966.

4047 **Jones, R. D.** Glen Smith Norville (1899–1963): Am. Assoc. Petroleum Geologists Bull., v. 49, no. 12, p. 2321–2322, portrait, 1965.

4169 **Jordan, Robert R.** Quaternary geology of Delaware, *in* Guidebook for Field Conference B–1, Central Atlantic Coastal Plain—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 15–23, illus., 1965.

The deposits which form a continuous veneer over the Coastal Plain of Delaware are reviewed here. The lower contact is an angular unconformity on beveled edges of older rocks up to Miocene in age; superjacent beds are Recent alluvium. The stratigraphic interval studied is possibly mid-Miocene to Recent, but from fossils and radiometric studies is conceded to be Pleistocene. Few "bench marks" are available for accurate delineation. Jordan favors the use of Columbia Formation for the undivided sequence in northern Delaware, elevated to Columbia Group in the south to include named formations. The lithology and genesis are discussed briefly.—G.D.C.

Kahn, J. S. *See* Newkirk, H. W. 4289

Kam, William. *See* Gillespie, J. B. 4140

4207 **Kane, Henry Edward.** Quaternary geology and geomorphic history of the southeastern portion of the Canon City Embayment, Colorado [abs.]: Dissert. Abs., v. 26, no. 7, p. 3864–3865, 1966.

4033 **Karlstrom, Thor N. V.** Resume of the Quaternary geology of the Upper Cook Inlet area and Matanuska River valley, *in* Guidebook for Field Conference F, Central and south central Alaska—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 114–141, illus., table, 1965.

In this most densely populated region of Alaska, extensive lowlands at the head of Cook Inlet occur at the intersection of three main valley systems: the Susitna River valley, the Matanuska Valley, and the Turnagain Arm Fjord. These separate the Alaska Range, Talkeetna Mountains, Chugach Mountains, and the Kenai Mountains. The region has been repeatedly glaciated, the extent of five Pleistocene glaciations being marked by remnants of various moraines and other features. The glacial record, chronology, and continental correlations are summarized by a table. The Matanuska Glacier is one of the largest glaciers now draining the central ice fields of the Chugach Mountains, reflecting a coastward inclined snow line. The various types of glacial and nonglacial deposits, fluctuations of sea level, and erosional features are described.—G.D.C.

Karrow, Paul F. *See* Dreimanis, Alexsis, 4150

Kennedy, G. C. *See* Carter, N. L. 4000

4296 **Kentucky Geological Survey.** Status of Kentucky areal geologic mapping program: Lexington, Ky., Kentucky Geol. Survey, scale 1:1,000,000, 1966.

4228 **King, M. S.** Wave velocities in rocks as a function of change in overburden pressure and pore fluid saturants: Geophysics, v. 31, no. 1, p. 50–73, illus., tables, 1966.

A system is described for determining precisely the dilatational and shear-wave group velocities in rock samples subjected to hydrostatic confining and internal pore pressures independently to 10,000 psi. Both velocities have been measured on three dry sandstones in directions perpendicular and parallel to the bedding plane. Two exhibited transverse isotropy with the bedding plane as the plane of symmetry, decreasing in degree as confining pressure increased. If effects of mechanical hysteresis of the rock were avoided, the velocities in sandstones depended on the simple difference between the hydrostatic confining pressure and internal pore pressure.—D.B.V.

3968 **Kinsman, David J. J.** Supratidal diagenesis of carbonate and non carbonate sediments in arid regions [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 620–621, 1966.

4275 **Klassen, R. W.** Surficial geology, Riding Mountain, west of principal meridian, Manitoba–Saskatchewan: Canada Geol. Survey Prelim. Ser. Map 16–1965, scale 1:253,440, 1966.

3969 **Klein, George deV.** Directional relationships between primary structures and current systems in a tide-dominated environment [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 621, 1966.

4022 **Klein, George deVries.** Dispersal and petrology of sandstones of Stanley–Jackfork boundary, Ouachita fold belt, Arkansas and Oklahoma: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 308–326, illus., table, 1966.

Petrologic and statistical studies of sandstones of uppermost Moyers and basal Wildhorse Mountain Formations which bracket the Stanley–Jackfork boundary show that sources for the sandstones were from south and north and to a lesser extent east in contrast to previous studies based on sedimentary structures which had indicated an eastern source. Sands delivered to Ouachita geosyncline distributed by turbidity currents and slump, then redistributed in part by axial currents producing axially oriented structures. In order of abundance sandstone types are upper Moyers subarkose, subgraywacke, arkose, graywacke, feldspathic graywacke, and orthoquartzite; basal Whitehorse Mountain orthoquartzite, subarkose, and subgraywacke. Feldspathic, subarkosic and arkosic types derived from south while orthoquartzites and subgraywackes derived from north with some orthoquartizte also from east, possibly the Illinois Basin.—S.P.S.

4332 **Klemic, Harry.** Geologic map of the Hammacksville quadrangle, Kentucky–Tennessee: U.S. Geol. Survey Geol. Quad. Map GQ-540, scale 1:24,000, section, text, 1966.

Test holes drilled for oil in limestone strata below the Chattanooga Shale in the Hammacksville quadrangle were dry. Minor amounts of limestone have been quarried. An extensive cave system, Glover's Cave, is located about four miles west-southwest of Trenton.—M.C.M.

3970 **Klovan, J. E.** Integrated method of facies and reservoir analysis as applied to Redwater field, Alberta [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 621, 1966.

Knapp, W. D. *See* Furnish, W. M. 4306

Knapp, W. D. *See* Strimple, H. L. 4338

Koch, John G. *See* Camp, C. L. 4008

4191 **Kovach, Robert L.** Seismic surface waves—Some observations and recent developments, *in* Physics and chemistry of the Earth, V. 6: New York, Pergamon Press, p. 251–314, illus., tables, 1965.

Observed seismic surface wave data, accumulated in the past 30 years, are discussed by seismic wave type and major geographic areas. Wave types include fundamental mode continental and oceanic Love and Raleigh waves, long-period Love and Rayleigh waves, and higher mode surface waves. Recently developed long-period seismographs are described also. A reference list of approximately 150 entries is included.—V.S.N.

4328 **Kracek, F. C.; Ksanda, J.; Cabri, L. J.** Phase relations in the silver tellurium system: Am. Mineralogist, v. 51, nos. 1–2, p. 14–28, illus., tables, 1966.

The liquidus falls from the melting temperature of Te to a eutectic at 343°C and 33.3 atomic percent Ag, then rises in several steps to the melting point of Ag_2Te at 960°C. $Ag_{5-x}Te_3$ has a transition at 295°C with Te present which decreases to 265°C with increasing Ag. This phase melts incongruently at 420°C to the γ phase plus melt which in turn melts incongruently at 460°C to Ag_2Te plus melt. The γ phase is not stable below 120±15°C and has a transition at 78°C. Between Ag_2Te and Ag, two immiscible liquids are stable above 881°C. A eutectic occurs at 869°C between Ag_2Te, Ag and a melt of 87.5 percent Ag.—E.H.R.

Ksanda, J. *See* Kracek, F. C. 4328

Kulm, L. D. *See* Byrne, John V. 4104

4112 **Kulm, L. D.** Influence of Cascadia Channel on abyssal sedimentation [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 649, 1966.

4176 **LaFleur, Robert G.** Ice stagnation deposits in the northern Hudson Lowland, *in* Guidebook for Field Conference A, New England–New York State—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 39–47, illus., 1965.

Kame and esker complexes, kame terraces, deltas, and thick glaciolacustrine rhythmites are particularly abundant east of the Hudson River and were deposited in this area during stagnation of the late Wisconsin (Cary) ice. Faulted and folded Cambrian and Ordovician bedrock contributed to the drift in proportion to their outcrops. The direction of ice flow nearly coincides with the N–S structural trend, so till composition varies little from bedrock lithologies, although a few cobbles were derived from the Precambrian rocks of the Adirondacks. The features visited are in the Troy quadrangle.—G.D.C.

4255 **Lamar, J. E.** (compiler). Annotated selected list of industrial mineral publications: Illinois Geol. Survey Indus. Minerals Note 25, 16 p., 1966.

Selected publications relating to the resources, occurrence, character, or uses of Illinois industrial minerals, including lead and zinc, are listed and briefly annotated when the title of the report does not adequately indicate its content.—Author's abstract

3972 **Landes, Kenneth K.** Petroleum in time and space [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 622, 1966.

Landy, R. A. *See* Hyde, C. 4325

4254 **Lane, Charles W.; Miller, Don E.** Geohydrology of Sedgwick County, Kansas: Kansas Geol. Survey Bull. 176, 100 p., illus., tables, 1965.

The oldest rock cropping out in Sedgwick County is the Permian Wellington Formation; surficial materials are unconsolidated deposits of clay, silt, sand, and gravel of Neogene age. Ground water is the most important mineral resource and constitutes essentially all water used in the County; its principal source is the unconsolidated deposits underlying the Arkansas Valley where well yields of from a few to over 2,000 gpm are readily obtained. This water is generally of moderate hardness and locally contains undesirable quantities of dissolved salt and iron. Several ground water maps and sections accompany the report.—*from* Authors' abstract

Langseth, M. G. *See* VonHerzen, R. P. 4189

4259 **Lanphere, Marvin A.; Dalrymple, G. Brent.** Simplified bulb–tracer system for argon analyses: Nature, v. 209, no. 5026, p. 902–903, illus., 1966.

A simplified, inexpensive, and portable bulb–tracer system used for argon analyses in the K–Ar dating laboratory of the U.S. Geological Survey is described. Tests have shown it to be as precise as any known system.—D.B.V.

4314 **LaRocque, G. A., Jr.** General availability of ground water and depth to water level in the Missouri River basin: U.S. Geol. Survey Hydrol. Inv. Atlas HA-217, scale 1:2,500,000, 1966.

3973 **Lathram, Ernest H.; Gryc, George.** New look at geology and petroleum potential of northern Alaska [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 622, 1966.

LeBlanc, R. J. *See* Bernard, H. A. 4136

4184 **Lee, Larry J.** A structural and petrological note on the Mazarn Synclinorium [abs.]: Arkansas Acad. Sci. Proc., v. 19, p. 88, 1965.

3975 **Lee, Pei-Jen; Winder, Gordon C.** Fabric of a Middle Ordovician Limestone at Colborne, Ontario [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 623, 1966.

4301 **Legget, R. F.; Brown, R. J. E.; Johnston, G. H.** Alluvial fan formation near Aklavik, Northwest Territories, Canada: Geol. Soc. America Bull., v. 77, no. 1, p. 15–29, illus., table, 1966.

An alluvial fan on the western rim of the Mackenzie Delta is composed predominantly of organic silt rather than the predicted sand or gravel, and cannot be used for a new town site in this area of perennially frozen ground. Adjacent source mountains are composed of sandstone and shale. Organic material is derived from vegetation growing on the fan.—A.G.

4208 **LeMasurier, Wesley Ernest.** Volcanic geology of Santa Rosa Range, Humboldt County, Nevada [abs.]: Dissert. Abs., v. 26, no. 7, p. 3865, 1966.

Lemke, R. W. *See* Richmond, G. M. 3918

3997 **Levengood, W. C.** Internal elastic energy variations in tektites: Jour. Geophys. Research, v. 71, no. 2, p. 613–618, illus., table, 1966.

Four varieties of tektites were quantitatively examined for stress response effects, using a technique based on surface defect formation. As a group the values of σ_c (critical stress for defect formation) and b (intercept constant) were similar in the tektites, and indicated a less ordered structure than in natural obsidian and more order than in commercial glasses. Both σ_c and b change systematically with the K–Ar ages. The nature of these variations suggests the formation of ordered, clustered groupings in the glass network which increase with the geologic age of the tektite. The general similarities in the structures of the tektites indicate a common environment of formation.—D.B.V.

4285 **Levinson, A. A.** A system of nomenclature for rare-earth minerals: Am. Mineralogist, v. 51, nos. 1–2, p. 152–158, 1966.

A group name, e.g., monazite, is suggested for rare-earth minerals for which the rare-earth distribution has not been determined. A species name, e.g., monazite-(Ce), monazite-(La), etc., is suggested for rare-earth minerals for which the rare-earth element distribution has been determined; the species name is obtained by appending the chemical symbol of the predominant rare-earth element to the group name.—Author's abstract

Lidz, Louis. *See* Saito, Tsunemasa. 4124

Lindstrom, G. R. *See* Williams, B. G. 3889

3976 **Ling, Hsin-Yi.** *Patagium* and some spumellarian (Radiolaria) genera [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 623, 1966.

4271 **Lipman, P. W.; Quinlivan, W. D.; Carr, W. J.; Anderson, R. E.** Geologic map of the Thirsty Canyon SE quadrangle, Nye County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ-489, scale 1:24,000, section, 1966.

The map sheet includes an index map showing the approximate boundary of the Timber Mountain caldera and location of the Thirsty Canyon SE quadrangle.—M.C.M.

3977 **Lipps, Jere H.** Planktonic foraminiferal zonation of California "Miocene" [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 623, 1966.

Lipps, Jere H. *See* Tappan, Helen N. 4059

Lipschutz, Michael E. *See* Heymann, Dieter. 3998

Lipschutz, Michael E. *See* Anders, Edward. 3999

Lipschutz, Michael E. *See* Anders, Edward. 4001

4209 **Lister, Gordon Frank.** The composition and origin of selected iron-titanium deposits [abs.]: Dissert. Abs., v. 26, no. 7, p. 3865–3866, 1966.

Loeblich, Alfred R., Jr. *See* Tappan, Helen. 4129

Long, J. J., Jr. *See* Weidie, A. E. 4092

Long, John J., Jr. *See* Weidie, Alfred E. 4091

4050 **Love, D. W.** Karl A. Schmidt (1900–1965): Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 403–405, portrait, 1966.

Love, J. D. *See* Denson, N. M. 3916

4028 **Love, J. D.; Montagne, John M. de la; Richmond, G. M.; Good, J. M.** Relation of Quaternary tectonics and volcanism to glaciation, Pt. D *in* Guidebook for Field Conference E, Northern and Middle Rocky Mountains—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p.,37–52, illus., 1965.

The Teton Mountains, Jackson Hole, Yellowstone National Park, and the valley of the Madison River lie along N–S to northwest trending normal faults, active in Quaternary time. Yellowstone Park is also in a zone of Quaternary and older volcanism that extends westward to the vicinity of Boise, Idaho. The region of Jackson Hole and Yellowstone Park, and the Beartooth Mountains to the northeast, was also the site of extensive Pleistocene glaciation. Differences of opinion exist, both as to identity of the glacial deposits and extent of the ice. The diversely related features in these areas are visited in this conference study, including the geysers and the Hebgen earthquake site.—G.D.C.

4004 **Lovering, J. F.; Morgan, J. W.** Reply [to discussion by L. A. Haskin and F. A. Frey, 1966, of paper on uranium and thorium abundances in Mohole basalt, 1965]: Jour. Geophys. Research, v. 71, no. 2, p. 690–691, 1966.

Haskin and Frey's (ibid., p. 688–689) clarification of their use of the term "primitive" in their earlier paper (1964) on the Mohole basalts is welcomed, but Lovering and Morgan see no reason to change their own view (1965) that the Mohole basalt is not an entirely satisfactory sample on which to base studies of fundamental geochemical and cosmochemical importance. The warning is underscored here.—D.B.V.

Lucas, W. H. *See* Barnes, D. F. 4101

Luedke, Robert G. *See* Burbank, Wilbur S. 4283

Luft, S. J. *See* Sargent, K. A. 4331

4141 **Lund, Charles R.** (compiler). Data from controlled drilling program in Lake County and the northern part of Cook County, Illinois: Illinois Geol. Survey Environmental Geology Note 9, 41 p., illus., tables, 1966.

Descriptions of character and sequence of materials and data on relative consistency, natural water content, and grain-size distribution are given for glacial deposits tested and sampled, as a part of a controlled drilling program, at four sites in Lake County and three in the northern part of Cook County, Illinois.—Author's abstract

3978 **Lundin, Robert F.** Ostracodes and Siluro-Devonian boundary in south-central Oklahoma [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 623–624, 1966.

4268 **Lyall, Kenneth D.** The origin of mechanical twinning in galena: Am. Mineralogist, v. 51, nos. 1–2, p. 243–247, illus., 1966.

From impact experiments, it seems likely that (441) twinning in natural galenas is due to blasting during mining. The same twinning was produced earlier in compression experiments but special dimensions and orientations were necessary.—E.H.R.

Mabey, Don R. *See* Hunt, Charles B. 4085

Mace, E. V. *See* Barnes, D. F. 4101

4258 **Macintyre, R. M.; York, Derek; Gittens, J.** Argon retentivity of nephelines: Nature, v. 209, no. 5024, p. 702–703, table, 1966.

Argon retention in nepheline has been tested by comparing K-Ar ages obtained on the nepheline with those obtained on coexisting biotite or amphibole in five alkaline rocks from Ontario. Preliminary results show that argon retentivity in nepheline is extremely high over periods of at least 10^9 yr. In no case is the nepheline age the lower; in one case agreement is exact, and in the other four the nepheline age is slightly higher. The nepheline ages come closer to concordance with those measured by the U-Pb and whole rock Rb-Sr methods; reasons for the divergences between results of the different methods are not yet clear.—D.B.V.

4237 **Mack, Harry.** Attenuation of controlled wave seismograph signals observed in cased boreholes: Geophysics, v. 31, no. 1, p. 243–252, illus., 1966.

The possibility of a frequency-dependent coupling, in the range 5–20 cps, between the deep-hole casing and the surrounding medium has been studied experimentally, using a vibrator and deep-hole seismometer. It was found that coupling does not vary in this frequency range and that all measured attenuation can be explained by normal propagation phenomena. The pulse amplitude attenuation was obtained numerically with different values of the attenuation constant Q; comparison with results of field measurements indicates that the value $1/Q = 0.012 \pm 0.004$ best fits the data obtained over 1,800 m of fairly uniform sandy shales.—D.B.V.

3980 **Mackenzie, Fred T.; Garrels, Robert M.** Silica–bicarbonate balance in oceans and early diagenesis [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 625, 1966.

4090 **Maclay, Robert W.** Reconnaissance of the geology and ground-water resources in the Aurora area, St. Louis County, Minnesota: U.S. Geol. Survey Water-Supply Paper 1809-U, p. U1–U20, illus., table, 1966.

The Aurora area, about 24 sq mi in the eastern Mesabi Iron Range of northeastern Minnesota, is a glaciated upland of drift-mantled slopes, channels, swamps, and glacial-lake plain. Bedrock is the late Precambrian Animikie Group consisting of taconite in the northern part and slightly metamorphosed argillite in the middle and southern parts. The porous and permeable ore zones of the St. James Mine yield large quantities of ground water, and small quantities are available from bedding planes and fractures in the argillite. Water is also available from unconsolidated sand and gravel in the Embarrass channel and glaciofluvial deposits along the Partridge River, and in small quantities from sandy to bouldery till. Water from unconsolidated deposits is hard with undesirable amounts of iron and manganese; bedrock aquifers yield water of better quality.—V.S.N.

4210 **Macqueen, Roger Webb.** Stratigraphy and sedimentology of the Mount Head Formation, Alberta, Canada [abs.]: Dissert. Abs., v. 26, no. 7, p. 3866, 1966.

3891 **Macurda, Donald B., Jr.** The functional morphology and stratigraphic distribution of the Mississippian blastoid *Orophocrinus*: Jour. Paleontology, v. 39, no. 6, p. 1045–1096, illus., 1965.

Differences in the position of the brachioles on the ambulacra, and the number of hydrospires, indicate that species of this widespread genus inhabited two separate environments: carbonate shelf, and biohermal. Ten valid species are recognized, including two new: *O. celticus* and *O. saltensis*. Species erroneously assigned to *Orophocrinus* by earlier authors are removed, and junior synonyms of valid species are listed. A key to species is offered, diagnostic characters are tabulated, and phylogeny, ontogeny, and functional morphology are discussed in detail.—R.E.G.

3894 **Macurda, Donald B., Jr.** Hydrodynamics of the Mississippian blastoid genus *Globoblastus*: Jour. Paleontology, v. 39, no. 6, p. 1209–1217, illus., 1965.

The hydrospire system of a spiraculate blastoid probably was two-way: in through pores and out through spiracles, by action of cilia. Pore area increased in size proportionately to increase in volume of hydrospires, which grew throughout ontogeny of the animal. Spiracle area increased at a slower rate, necessitating increasing velocity of output currents with growth.—R.E.G.

4006 **Macurda, Donald B., Jr.** The ontogeny of the Mississippian blastoid *Orophocrinus*: Jour. Paleontology, v. 40, no. 1, p. 92–124, illus., tables, 1966.

Plates grew by addition of calcite at their edges, but at different rates along different edges. Growth along one edge was constant, and is used as a datum for comparison of growth along other edges. Growth curves thus derived provide means of comparing ontogenies of different individuals, populations, or taxa. The genus is revised, the type species *Orophocrinus stelliformis* (Owen and Shumard) redescribed, and *O. campanulatus* (Hambach) and *O. (Codaster) whitei* Whitfield *(non* Hall, *part)* placed in its synonymy. *Codaster whitei* Hall is assigned to *Hydroblastus*. *Orophocrinus* occurs in Upper Kinderhookian and Lower Osagean series of Illinois, Iowa, Missouri, New Mexico, and Arizona, and in the Tournaisian and Visean of Europe.—R.E.G.

Maher, Louis J. *See* Black, Robert F. 4143

Major, C. F. *See* Bernard, H. A. 4136

Malde, H. E. *See* Fryxell, Roald. 3919

3981 **Malek-Aslani, M.** Habitat of oil in carbonate rocks [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 625, 1966.

Malloy, R. J. *See* Barnes, D. F. 4101

3904 **Maloney, Neil J.** Particle density effects in estimating median diameters of sands: Oriente Univ. Inst. Oceanog. Bol., v. 4, no. 1, p. 184–190, illus., table, 1965.

Median particle diameters were obtained from eight Oregon beach sands containing between 3 and 98 percent heavy minerals by using an Emery settling tube, a volume sieve analysis, and a weight analysis. The settling tube diameters are coarser than the sieve results when each fraction is weighed, the difference increasing with concentration of heavy minerals. The volume sieve analyses are almost identical with the weight analyses for samples with less than 40 percent heavy minerals; above 40 percent, however, the weight analyses give increasingly finer median diameters than the volume analyses. The accuracy of the settling tube method can be improved by adjusting its estimate of the median diameter for the heavy mineral concentration.—G.D.C.

Maloney, Neil J. *See* Byrne, John V. 4104

3982 **Manheim, Frank T.** Distribution of interstitial salts in drill cores from Atlantic Ocean floor off Florida [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 625–626, 1966.

4166 **Maricelli, J. J.** Computers simplify log applications [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 626, 1966.

3928 **Markland, G. D.** Geology of the Moose Mountain mine and its application to mining and milling: Canadian Mining and Metall. Bull., v. 59, no. 646, p. 159–170, 1966.

The Moose Mountain mine is located in a belt of Precambrian volcanic rocks 20 miles north of Sudbury, Ontario. The ore is believed to have been formed in an environment of active volcanism, being part of a pyroclastic and volcanic series where only the iron-formation and chert qualify as chemical sediments. The volcanic environment, subsequent regional tectonics and metamorphism produced orebodies which differ from the main sedimentary iron ranges of the world in such features as continuity, grade, structure and metallurgical characteristics. The orebodies occur as relatively small lenses which have been complexly folded, faulted, and intruded by acidic and basic dikes.—Author's abstract

Martin, Luciano. *See* Grant, F. S. 4231

4263 **Mason, Brian.** The enstatite chondrites: Geochim. et Cosmochim. Acta, v. 30, no. 1, p. 23–39, illus., tables, 1966.

Fifteen enstatite chondrites have been recognized. Their essential minerals are enstatite and(or) clinoenstatite, kamacite, troilite, and sometimes plagioclase; a considerable number of accessory minerals, some unique to this group, have been recorded. Chondritic structure is seldom well developed, and some appear to be completely recrystallized and entirely devoid of chondrules. Their bulk chemical composition is similar throughout, the principal variable being total Fe. Some trace elements, however, show remarkable variation between the individual meteorites. Geochemically enstatite chondrites are characterized by a high degree of reduction.—D.B.V.

Mason, Brian. *See* Buseck, Peter R. 4303

Mason, Brian. *See* Donnay, Gabrielle. 4320

Matsch, C. L. *See* Wright, H. E., Jr. 4187

4113 **Mayuga, W. N.** Recent development in Wilmington-Long Beach unit oil field [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 649, 1966.

3979 **McBride, Earle F.** Textures and structures in Catahoula (Gueydan) Tuff, south-central Texas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 624, 1966.

4063 **McCulloh, Thane H.** Gravimetric effects of petroleum accumulations—A preliminary summary: U.S. Geol. Survey Circ. 530, 4 p., 1966.

Negative gravity anomalies of local extent and with amplitudes of 1.2 mgal or less have been observed over some known petroleum and natural gas fields in southern California and South Dagestan, U.S.S.R. Field evidence, laboratory measurements, and theory indicate that these anomalies are mainly the result of hydrocarbon pore fluids of densities significantly lower than that of water. Gravity meters already available have the precision necessary to detect some of these anomalies from surface measurements. In addition, a high-precision borehole gravity meter has been developed, that can be used in wells with a casing 7 in. or more in diameter and at temperatures below 100°C. These observations and the gravimeter should aid in the search for new petroleum fields and new reservoirs in known fields.—*from* Author's abstract

4277 **McCullough, Edgar J., Jr.** Historical geology: Dubuque, Iowa, Wm. C. Brown Co., [227] p., illus. [1965?].

The book is divided into eight sections, the first of which discusses methods. The section on paleogeography is divided into study of Arizona, based on isopach maps, and of the Jurassic period in the United States, based on paleogeographic maps. Geologic-map interpretation comprises the third section. Most of the longest section, on paleontology, is given to descriptions of the phyla. A proposed lecture outline and study questions comprise the fifth and sixth sections, and a glossary and 16 maps to be used in the studies complete the book.—E.S.L.

McFarlin, Peter F. *See* Pratt, Richard M. 4311

4161 **McGuire, William H.** Exploration objectives in the Cambro-Ordovician of Kentucky [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 624, 1966.

4265 **McIntyre, Andrew; Bé, Allan W. H.** Coccolithophorids as ecologic indicators in oceanic sediments [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 624–625, 1966.

4256 **McLaughlin, Thad G.** Ground water in Huerfano County, Colorado: U.S. Geol. Survey Water-Supply Paper 1805, 91 p., illus., tables, geol. map, 1966.

Alluvial aquifers in Huerfano County are in relatively thin surficial deposits in the valleys and beneath pediments and are recharged principally by percolation of precipitation downward to the water table and by percolation through beds of streams. Bedrock aquifers comprise older consolidated rocks such as sandstone and limestone and are recharged principally by infiltration of precipitation and percolation through stream beds on outcrop areas. Water in most bedrock formations is under artesian pressure. Much of the water is highly mineralized. Possible solutions to the water problem in the County would involve development of mine water for industrial and other uses, water from alluvium of larger streams for industry and irrigation, and water from bedrock aquifers for stock supplies and perhaps also for industry and irrigation.—*from* Author's abstract

3933 **McNulty, C. L., Jr.** Nomenclature of uppermost Eagle Ford Formation in northeastern Texas: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 375–379, illus., 1966.

The uppermost part of the Eagle Ford Formation in northeastern Texas consists mainly of shale with an intertonguing sandstone unit. The sandstone unit is redefined as the Bells Sandstone Member and the overlying shale unit is redefined as the Maribel Shale Member. Marine faunas from the two members suggest a latest Turonian age (Late Cretaceous).—A.E.R.

3983 **Meade, Robert H.** Factors influencing early stages of compaction of clays and sands—Review [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 626–627, 1966.

4042 **Melson, William G.; Bowen, Vaughan T.; vanAndel, Tjeerd H.; Siever, Raymond.** Greenstones from the central valley of the Mid-Atlantic Ridge: Nature, v. 209, no. 5023, p. 604–605, table, 1966.

Greenstones dredged from the Mid-Atlantic Ridge are described briefly, with chemical analysis. Their occurrence raises several questions about the nature of the Mid-Atlantic Ridge. If such rocks prove to be quantitatively important constituents of parts of the ridge, interpretations of seismic, magnetic, and gravity data cannot be based on models which assume the presence of only fresh basaltic rocks, serpentine, and unserpentinized ultramafic rocks in a simple layer-cake sequence.—D.B.V.

4002 **Menard, H. W.** Fracture zones and offsets of the East Pacific rise: Jour. Geophys. Research, v. 71, no. 2, p. 682–685, illus., 1966.

Data from new soundings and other sources permit extensive recontouring of the East Pacific rise. The crest of the rise is offset in at least 17 places, and in 10 of these the displacement occurs on a typical linear fracture zone. Between offsets the crest trends almost north–south in most places, whereas the fracture zones trend roughly east–west. At least one great fracture zone extends beyond the limits of the rise; this casts doubt on the idea that there is a genetic connection between the great fracture zones and the rise.—D.B.V.

4192 **Menard, H. W.** Sea floor relief and mantle convection, *in* Physics and chemistry of the Earth, V. 6: New York, Pergamon Press, p. 315–364, illus., 1965.

Geophysical evidence derived from sea-floor topography is examined for its bearing on the hypothesis of convection in the mantle. The characteristics of oceanic rises and ridges—high heat flow, seismicity, rifting, parallel ridges and troughs, transverse offsets on fracture zones, flood basalts, and thin oceanic crustal layer—are readily explained if they are produced by transient convection cells in the mantle. Available data of marine geophysics do not indicate the three dimensional shape of convection ceils or even if they exist. Distribution of effects, however, provides clues to shape of the cells and indicates a distribution encircling continental shields rather than centered in ocean basins. It suggests that primary control of convection is the separation of light and dense fractions of the mantle under continents; thermal convection under ridges and rises is secondary.—V.S.N.

3984 **Merriam, Daniel F.; Harbaugh, John W.** Process-response model for marine-organism communities [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 627, 1966.

3893 **Meyer, David L.** Plate growth in some platycrinid crinoids: Jour. Paleontology, v. 39, no. 6, p. 1207–1209, illus., 1965.

Striations parallel to plate borders in internal surfaces are interpreted as growth lines.—R.E.G.

4300 **Michael, Eugene D.** Large lateral displacement on Garlock fault, California, as measured from offset fault system: Geol. Soc. America Bull., v. 77, no. 1, p. 111–113, illus., 1966.

In the northern Mojave Desert northwest-trending lines that separate structural blocks with similarly oriented fault systems are named the Blackwater and Piute lines. These lines apparently are displaced 46 miles in a left-lateral sense by the Garlock fault. This evidence supports that of Smith (1962), who proposed 40 miles of left-lateral movement based on offset dike swarms.—J.G.V.

4020 **Miller, D. N., Jr.** Petrology of Pierce Canyon redbeds, Delaware basin, Texas and New Mexico: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 283–307, illus., table, 1966.

The Permian Pierce Canyon Formation is a brick-red siltstone 350 feet thick that probably was derived from a granitic source in an arid climate transported by wind, and deposited in a shallow saline lagoon. The Dewey Lake Formation and the Quartermaster Formation have essentially identical mineral assemblages and occupy the same stratigraphic position as the Pierce Canyon, so the name Pierce Canyon should be replaced by Dewey Lake. These redbeds can be distinguished from the overlying Triassic redbeds by eight distinct mineralogical differences.—W.C.C.

Miller, Don E. *See* Lane, Charles W. 4254

4257 **Miller, G. A.; Evenson, R. E.** Utilization of ground water in the Santa Maria Valley area, California: U.S. Geol. Survey Water-Supply Paper 1819-A, p. A1-A24, illus., tables, 1966.

The aquifer system in the Santa Maria Valley area is composed of permeable beds of gravel and sand, locally separated by relatively impermeable beds of silt and clay; most of the ground water is in the undifferentiated Pliocene and Pleistocene deposits, but the main water-bearing zone is in the lower part of the Recent alluvium. Overdraft since about 1946 has resulted in a significant decline in water levels. Storage depletion, not estimated in the seaward ends of the aquifers, will result as the fresh water-sea water interface moves landward in response to continuing decrease in hydraulic gradient in the aquifer system. Limited sea water encroachment may have occurred at the offshore ends of the aquifers.—M.C.M.

4323 **Moench, Robert H.; Drake, Avery Ala, Jr.** Economic geology of the Idaho Springs district, Clear Creek and Gilpin Counties, Colorado: U.S. Geol. Survey Bull. 1208, 91 p., illus., tables, geol. map, 1966.

This district, in the Front Range mineral belt, has yielded about sixty-five million dollars worth of gold, silver, and base metal ores since 1860. The ores fill veins that cut Precambrian gneissic and granitic rocks, and consist of pyrite, sphalerite, galena, chalcopyrite, and tennantite in a gangue of quartz and locally, carbonate. The veins are arranged in a zonal pattern that is also marked by systematic changes in precious and base metal content. Ore shoots occur within the veins and are largely controlled by vein deflections. About 135 mines have workings of over 100 feet in length although most are partly or completely inaccessible. It is unlikely that significant quantities of metals will be produced in the future unless new low-cost mining methods are developed.—A.A.D.

Monster, J. *See* Thode, H. G. 3925

Montagne, John M. de la. *See* Denson, N. M. 3916

Montagne, John M. de la. *See* Love, J. D. 4028

4287 **Moore, Paul B.** The crystal structure of metastrengite and its relationship to strengite and phosphophyllite: Am. Mineralogist, v. 51, nos. 1-2, p. 168-176, illus., tables, 1966.

The structure [of metastrengite] consists of linkages of octahedra and phosphate tetrahedra. As in strengite, the water molecules appear at the ends of an octahedral edge. The major differences in the strengite and metastrengite structures are attributed to the "tilt" of the tetrahedra. Metastrengite-like subcells in the phosphophyllite structure confirm Strunz's suggestion of structural similarities between metastrengite and phosphophyllite.—*from* Author's abstract

3987 **Moorhouse, M. D.** Eagle Plain basin of Yukon Territory [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 628, 1966.

More, K. *See* Ebeoglu, D. B. 4064

Morgan, J. P. *See* Gould, H. R. 4135

Morgan, J. W. *See* Lovering, J. F. 4004

Moriarty, James R. *See* Ezell, Paul. 4168

4048 **Morley, Harold T.** Robert Jennings Riggs (1888–1965): Am. Assoc. Petroleum Geologists Bull., v. 49, no. 12, p. 2322–2324, portrait, 1965.

Morrison, Anne K. *See* Dennison, John M. 4154

Morrison, R. B. *See* Bright, R. C. 4026

3921 **Morrison, Roger B.** Route from Denver, Colorado, to Salt Lake City, Utah via the Denver and Rio Grande Western Railroad (Moffat Tunnel Route)—Field Conf. I, Guidebook 1st day, Supp.—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: [Lincoln, Nebr., Nebraska Acad. Sci.] 68 p., illus., 1965.

This supplementary guidebook for the one-day railroad trip incorporates field notes by several contributors. General geologic features and Cenozoic erosional history are described for the Front Range region, Middle Park, Glenwood Canyon area, and Colorado Plateau including the Uncompahgre arch and its effect on the history of the Colorado River. Physiographic diagrams, generalized Quaternary stratigraphy, columnar and cross sections, and correlation charts are included in addition to road logs.—G.D.C.

3988 **Mound, Michael C.** Late Devonian conodonts from Alberta subsurface [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 628, 1966.

4162 **Mountjoy, Eric W.** Unconformities in Phanerozoic succession of northern Jasper National Park, Alberta [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 628, 1966.

Mudge, M. R. *See* Richmond, G. M. 3918

4282 **Mudge, Melville R.** Geologic map of the Glenn Creek quadrangle, Lewis and, Clark, and Teton Counties, Montana: U.S. Geol. Survey Geol. Quad. Map GQ-499, scale 1:24,000, sections, 1966.

The map sheet includes a table of comparison of nomenclature as used on this map with that of G. E. McGill and D. A. Sommers (in press).—M.C.M.

Mudie, John D. *See* Ezell, Paul. 4168

4175 **Muller, E. H.** New York, Pt. 2 *in* Guidebook for Field Conference A, New England–New York State—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 39–92, illus., 1965.

This part of the INQUA guidebook covers the glacial and post-glacial features of New York State, including the Adirondack Mountains bedrock and drift, Oneida sublobes, proglacial lake deposits and deep troughs of the Finger Lakes region, exposed sections, Olean and Binghamton till, the Salamanca re-entrant in southwestern New York which apparently escaped glaciation, the bedrock escarpments in western New York, and the recession of Niagara Falls. A few contributors are cited separately.—G.D.C.

Mumpton, F. A. *See* Hostetler, P. B. 4292

4172 **Murata, K. J.; Richter, D. H.** Chemistry of the lavas of the 1959–60 eruption of Kilauea Volcano, Hawaii: U.S. Geol. Survey Prof. Paper 537-A, p. A1-A26, illus., tables, 1966.

During the 1959–60 eruption of Kilauea Volcano, the outpouring magma was sampled systematically to obtain detailed information on chronological changes in composition. Temporal variations in composition, when correlated with mineralogy, lava temperature, rate of discharge, and other parameters measured during the eruption, provide new insight into the preeruptional crystallization of basaltic magma, entailing intratelluric depositions of various phenocrysts and migration of rest liquids. The 1959 summit, the late-1960 flank, and the early-1960 flank magmas

clearly showed trends of differentiation resulting from separation of various proportions of three major minerals—olivine, clinopyroxene, and plagioclase—at progressively lower temperature. Compositions of lavas expelled during the first phase of the 1959 summit eruption suggest the primitive Kilauea magma holds at least 10 percent magnesia.—*from* Authors' abstract

Murphy, J. F. *See* Richmond, G. M. 3917

Murray, G. E. *See* Weidie, A. E. 4092

3897 **Murray, Grover E.** Salt structures of Gulf of Mexico Basin—A review: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 439–478, illus., 1966.

Diapiric salt structures are concentrated in the Gulf of Mexico and adjacent areas of greater than normal sedimentary thickness, and their times of growth appear to be related to periods of greater than normal sedimentary accumulation. The author suggests that salt ridges or anticlines, as well as lesser structures which have a definite regional strike alinement, may have been positioned by regional strike flexures or strike-fault zones, and that the heights of the salt spines above the ridges or anticlines are probably related to the thickness of sediments above the rising mass of salt.—A.E.R.

3989 **Murray, Raymond C.** Compaction phenomena in gypsum and anhydrite [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 628–629, 1966.

4138 **Myers, B. N.; Dale, O. C.** Ground-water resources of Bee County, Texas: Texas Water Devel. Board Rept. 17, 101 p., illus., tables, 1966.

Outcrops of sedimentary deposits that yield fresh to slightly saline ground water in Bee County are, in order of decreasing age: Miocene Catahoula Tuff, Oakville Sandstone, and Lagarto Clay; Pliocene Goliad Sand; Pleistocene Lissie Formation and Beaumont Clay; and Recent alluvium. Ground water moves southeastward from areas of recharge to areas of discharge at about 10 feet per yr. Levels have declined only slightly in the last 25 years. Areas most favorable for development of additional supplies of ground water are in the southeastern half of the County where fresh to slightly saline water-bearing sand is thickest. Chemical quality of the ground water is generally suitable for public supply, many industrial uses, and supplemental irrigation. Tables show records of wells, drillers' logs, and chemical analyses of water.—*from* Authors' abstract

Nayudu, Y. R. *See* Fuller, M. D. 4030

Neff, G. E. *See* Richmond, G. M. 4027

3990 **Nelson, Bruce W.** Diagenesis in estuarine sediments [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 629, 1966.

4242 **Nelson, J. G.** Man and geomorphic process in the Chemung River Valley, New York and Pennsylvania: Assoc. Am. Geographers Annals, v. 56, no. 1, p. 24–32, 1966.

Observation of flood effects and other evidence indicate that overbank deposition on the Chemung floodplain has accelerated in very recent geologic time, principally within the last one thousand years. Clearing and cultivation are known to have increased runoff, erosion, and flood heights in the Chemung Valley. Such increases are believed to have been associated with more extensive flooding, higher stream sediment loads, and more rapid overbank deposition on the floodplain. These effects seem primarily attributable to American settlement, although Indians probably initiated the sequence of changes centuries ago.—*from* Author's abstract

3991 **Newell, Norman D.** Paraconformities [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 629, 1966.

4289 **Newkirk, H. W.; Smith, D. K.; Kahn, J. S.** Synthetic bromellite—[Pt.] III, Some optical properties: Am. Mineralogist, v. 51, nos. 1–2, p. 141–151, illus., tables, 1966.

The transmittance and refracting properties of BeO were determined in the visible region of the spectrum. Values of the index of refraction for the ordinary ray range from 1.71450 to 0.690 μ to 1.73039 at 0.430 μ and for the extraordinary ray from 1.73041 at 0.680 μ to 1.74556 at 0.440 μ. The temperature coefficient for the ordinary ray was determined to be $+8.18\times10^{-6}/^{\circ}C$ and for the extraordinary ray $+13.40\times10^{-6}/^{\circ}C$. The experimental data were fitted to a two term Sellmeier equation. Dispersive and resolving properties were calculated permitting the evaluation of BeO as a lens material.—Authors' abstract

4312 **Newton, Robert C.** Kyanite–sillimanite equilibrium at 750°C: Science, v. 151, no. 3715, p. 1222–1225, illus., table, 1966.

Reversal of the kyanite–sillimanite inversion has been accomplished hydrothermally at 750°C. The inversion pressure at 750°C is 8.1±0.4 kilobars. The calculated pressure–temperature slope at this point is 17.7±1.0 bars per degree celsius. Geologically, this result seems more plausible than previous estimates of the location of the boundary. When combined with other work on the relative stability of andalusite, the data indicate that andalusite cannot be stable at a pressure greater than 4.2 kilobars.—Author's abstract

Nichols, Donald R. *See* Ferrians, Oscar J., Jr. 4019

3992 **Nicoll, Robert S.; Rexroad, Carl B.** Conodont zones in Salamonie Dolomite and related Silurian strata of southeastern Indiana [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 629–630, 1966.

Nielsen, Betty. *See* Heymann, Dieter. 3998

3993 **Nielsen, John P.; Smith, R. J.** Consolidation characteristics of selected north Pacific sediment clays [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 630, 1966.

4068 **Noble, Frank J.** Huntington Beach offshore—Parcel 14 [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 649, 1966.

4132 **Nolan, Thomas B.** Mineral fluids and America's future, *in* Fluids in subsurface environments—A symposium: Am. Assoc. Petroleum Geologists Mem. 4, p. 11–19, 1965.

Production of subsurface mineral fluids (not including ground water) and substances recovered from them in the United States increased in the period 1946 to 1962. The predicted annual demand for oil and gas by the year 2000 is several times the current domestic production. The habitat of helium, in particular demand, is becoming better known. About one-sixth of our water supply comes from ground water, a third of which is not being replaced after withdrawal; its behavior, quality and quantity are geologically interrelated. Subsurface saline waters, with improved techniques, can provide additional fresh water; some brines are sources of valuable chemicals. Thermal waters and steam, being developed for power, are considered for recovery of valuable chemicals. New uses for low-value fluids include "fluidizing" solids for easier transport, and "solution mining" of low-grade ores.—G.D.C.

4246 **Oertel, G.** The mechanism of faulting in clay experiments: Tectonophysics, v. 2, no. 5, p. 343–393, illus., 1965.

A soft clay paste body, deformed under a homogeneous strain-rate field with strain rate of general type and all three principal strain rates different, exhibits, in both elongation and compression, four families of faults, none with principal axis of strain, and all forming small angles with the plane of smallest and intermediate principal axes of strain. The array of all four has orthorhombic symmetry. Homogeneous stress fields are demonstrated. Attitudes of fault planes and directions

of slip do not agree with Coulomb theory. Five assumptions about mechanism explain such related phenomena as fault patterns in clay experiments with plane-strain rates or with different ductilities of clay, and appearance of additional systems in late stages of experiments with general strains. Application of results to interpretations of fault patterns in southern California is discussed.—V.S.N.

Oles, Keith F. *See* Enlows, Harold E. 4108

4114 **Olsson, Richard K.; Davids, Robert N.** Paleogeographic and paleoecologic analysis of planktonic Foraminifera [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 630, 1966.

4115 **Ostroff, A. G.** Application of water-classification methods to waters from carbonate formations [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 630–631, 1966.

4269 **Outerbridge, William F.** Geologic map of the Paintsville quadrangle, Johnson and Floyd Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-495, scale 1:24,000, section, text, 1966.

The principal mineral resources of the Paintsville quadrangle are coal, gas, sandstone, shale, and burnt clay. Coal has been mined from about 12 beds; at present the most important are the Fire Clay and the Van Lear. Gas is produced in many localities, wells having an initial open flow of about 100,000–500,000 cubic feet and rock pressure of 200–800 psi; productive horizons include Mississippian Greenbrier Limestone, Devonian Ohio Shale, and Silurian dolomite and sandstone. Sandstone for various purposes has been quarried from beds between Van Lear coal bed and the coal bed next below the Van Lear and from the top of the Lee Formation. Shale from the Lee and Breathitt Formations has many uses.—M.C.M.

4211 **Ovenshine, Alexander Thomas.** Sedimentary structures in portions of the Gowganda Formation, north shore of Lake Huron, Canada [abs.]: Dissert. Abs., v. 26, no. 7, p. 3866–3867, 1966.

3909 **Park, W. H.** Kern Front oil field: California Div. Oil and Gas, California Oil Fields—Summ. Operations, v. 51, no. 1, p. 13–22, illus., tables, 1965.

The stratigraphic sequence of the Kern Front field, from basement complex and overlying Eocene Walker Formation to the Pleistocene Kern River Formation is outlined and illustrated by a cross section. Oil entrapment in the field results from faulting and the rapid change from sands to silts and shales in an updip direction. All oil production comes from the Chanac, Etchegoin, and Kern River Formations.—M.C.M.

4326 **Parry, W. T.; Reeves, C. C., Jr.** Lacustrine glauconitic mica from pluvial Lake Mound, Lynn and Terry Counties, Texas: Am. Mineralogist, v. 51, nos. 1–2, p. 229–235, illus., tables, 1966.

Authigenic glauconitic mica, formed by fixation of iron and potassium in clay mineral lattices, occurs in clastic sands and lacustrine dolomites beneath the present playa of Lake Mound, and has been identified by X-ray diffraction, optical data, differential thermal and chemical analysis. This occurrence indicates that glauconitic mica can form from montmorillonitic materials in non-marine environments, and thus glauconitic mica is not an infallible indicator of marine conditions.—B.C.H.

Parsley, R. L. *See* Hofman, H. J. 4011

Patton, John B. *See* Becker, Leroy E. 3942

4116 **Perkins, Bobby F.** Rock-boring organisms as markers of stratigraphic breaks [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 631, 1966.

4117 **Pessagno, Emile A.** Eaglefordian (Cenomanian–Turonian) stratigraphy in Mexico and Texas [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 631, 1966.

4272 **Pessl, Fred, Jr.** Surficial geologic map of the Fitchville quadrangle, New London County, Connecticut: U.S. Geol. Survey Geol. Quad. Map GQ-485, scale 1:24,000, separate text, 1966.

No distinct evidence of early Pleistocene glaciation is recognized in the Fitchville quadrangle; all glacial deposits mapped are believed to be of Wisconsin age. Striae indicate that the glacier advanced across the quadrangle from the northwest to the southeast. Glacial deposits are till (most extensive), ice-contact deposits, and valley-train deposits. Stratified drift is subdivided into ice-contact and valley-train deposits, and the age relationship between these deposits is indicated where recognized. The most valuable natural resource is sand and gravel from the stratified drift.—M.C.M.

Pessl, Fred, Jr. *See* Dixon, H. Roberta. 4281

4212 **Pestrong, Raymond.** The development of drainage patterns on tidal marshes [abs.]: Dissert. Abs., v. 26, no. 7, p. 3867, 1966.

4118 **Peterson, James A.** Distribution and origin of Pennsylvanian carbonate mounds, Paradox basin [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 631, 1966.

4119 **Peterson, Melvin N. A.; vonderBorch, Christopher C.** Rates and mechanisms in formation of dolomite [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 631–632, 1966.

4213 **Pettyjohn, Wayne Arvin.** Geology of a part of west-central South Dakota [abs.]: Dissert. Abs., v. 26, no. 7, p. 3867, 1966.

4017 **Péwé, Troy L.** Resume of the Quaternary geology of the Fairbanks area, *in* Guidebook for Field Conference F, Central and south central Alaska—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 6–36, illus., table, geol. map, 1965.

The Fairbanks area, about 100 miles south of the Arctic Circle, north of the broad Tanana River valley, is mostly maturely dissected upland 2,000 to 3,000 feet in altitude. Central Alaska has not been glaciated except in small local mountain masses, but glaciers from the Alaska Range came within 50 miles of Fairbanks, and heavily loaded rivers deposited several hundred feet of silt, sand, and gravel in the main valley, and over 400 feet in the upland creeks. Loess blown from the flood plain and outwash plains blankets middle upland slopes. Alternating deposition and erosion, formation and destruction of permafrost, and climatic fluctuations are recorded. Several alluviations reconcentrated gold placers in the stream channels and retransported loess to valley bottoms to form organic-rich permafrost and partly bury thawed ice wedges in silt of Wisconsin age.—G.D.C.

4034 **Péwé, Troy L.** Resume of Quaternary geology of the Delta River area, Alaska Range, *in* Guidebook for Field Conference F, Central and south central Alaska—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 55–93, illus., 1965.

The Delta River rising on the south side of the great glacially sculptured arcuate Alaska Range, flows north in a pass through which Quaternary glaciers formerly moved north. At least four glaciations are recorded in this area; on the north side valley glaciers remained with terminal bulbs in the Tanana River valley; on the south side the glaciers coalesced into large piedmont ice sheets over the lowlands. The features by which the advances are recognized are seen along the Richardson Highway, which also crosses the Denali fault, one of the longest fault zones in Alaska. Recent movement is indicated by offset post-Pleistocene alluvial fans and glacial deposits of Donnelly age across the Delta River. Some of the largest glaciers in the Range occupy segments of the fault trough today; the glaciology of the Gulkana-College Glacier area is described.—G.D.C.

4316 **Péwé, Troy L.; Wahrhaftig, Clyde; Weber, Florence.** Geologic map of the Fairbanks quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-455, scale 1:250,000, separate text, 1966.

The text consists of a description of map units—unconsolidated sedimentary deposits, consolidated sedimentary and metamorphic rocks, intrusive igneous rocks, and extrusive igneous rocks—and a 44-item bibliography.—M.C.M.

3930 **Pierce, Kenneth L.; Armstrong, Richard L.** Tuscarora fault, an Acadian(?) bedding-plane fault in central Appalachian Valley and Ridge province: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 385–390, illus., table, 1966.

A major bedding-plane fault, here named the Tuscarora fault, is present over a large area in south-central Pennsylvania. K–Ar dating of mylonite from the fault zone suggests that movement may be related to folding and faulting in earliest Mississippian time in central Pennsylvania. Subsequent orogeny in late Paleozoic time deformed and obscured these structures.—A.E.R.

4261 **Pough, Frederick H.** New cuttable gem materials from Mexico: Jour. Gemmology, v. 10, no. 1, p. 10–17, illus., 1966.

For the first time, a new find of axinite in Baja California has made considerable quantities of this mineral available for amateur and professional lapidaries, although it is darker than desirable. Other minerals of gem quality found in this State are sphene and clinozoisite, some, like axinite, associated with scheelite mines. In the Charcas lead mine near San Luis Potosí, danburite is found in considerable abundance, although it is usually considered to be a rare mineral. Its occurrence and appearance are described briefly.—G.D.C.

4311 **Pratt, Richard M.; McFarlin, Peter F.** Manganese pavements on the Blake Plateau: Science, v. 151, no. 3714, p. 1080–1082, illus., 1966.

Dredge samples and photographs from the Blake Plateau, off the southeast coast of the United States, indicate that a layer of manganese oxide forms pavement that may be continuous over an area of about 5,000 square kilometers. The manganese pavement grades into round manganese nodules to the south and east and into phosphate nodules to the west. The Gulf Stream probably maintains a very unusual environment that prohibits deposition of clastic sediment and permits accretion of manganese pavements.—Authors' abstract

4120 **Pray, Lloyd C.; Choquette, Philip W.** Genesis of carbonate reservoir facies [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 632, 1966.

4069 **Ptacek, Anton D.** Chronology of deformation of Paleozoic and Tertiary succession near Railroad Valley, Nevada [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 650, 1966.

4319 **Pye, E. G.; Fenwick, K. G.** Atikokan–Lakehead sheet (geological compilation series), Kenora, Rainy River and Thunder Bay Districts: Ontario Dept. Mines Map 2065, scale 1:253,440, text, 1965.

The map area contains deposits of asbestos, barite, beryl, calcite, cobalt, copper, feldspar, gold, gravel, iron, lead, lithium, manganese, marl, molybdenum, nickel, peat, platinum, pyrite (sulfur), shale, silver, stone, talc, and zinc. Lists of producing and past-producing mines are included on the map sheet.—M.C.M.

Quinlivan, W. D. *See* Lipman, P. W. 4271

4182 **Quinn, James Harrison.** Monadnocks, divides and Ozark physiography: Arkansas Acad. Sci. Proc., v. 19, p. 90–97, illus., 1965.

Pedimentation and peneplanation are defined and described. The physiography of the Ozarks has been described in terms of rejuvenated peneplains, but Quinn believes the escarpments, divides, and buttes have been produced in arid times by pedimentation of extensive surfaces dissected by stream entrenchment during humid times. The validity of the graded stream concept, and its applicability to the process of rejuvenation is discussed.—E.S.L.

Quirk, J. P. *See* Williams, B. G. 3889

4009 **Radinsky, Leonard B.** *Pataecops*, new name for *Pataecus* Radinsky, 1965: Jour. Paleontology, v. 40, no. 1, p. 222, 1966.

4290 **Ramsden, A. R.; Cameron, E. N.** Kamacite and taenite superstructures and a metastable tetragonal phase in iron meteorites: Am. Mineralogist, v. 51, nos. 1–2, p. 37–55, illus., tables, 1966.

Kamacite and taenite in iron meteorites have cubic superstructures in which the unit cell edges are respectively three times and two times those of the disordered phases. Certain iron meteorites also contain a tetragonal phase that seemingly has the same chemical composition as kamacite. This is considered to be a transitional state in the transformation of γ phase alloy into α–phase alloy (kamacite).—Authors' abstract

3931 **Raup, Omer B.** Clay mineralogy of Pennsylvanian redbeds and associated rocks flanking Ancestral Front Range of central Colorado: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 251–268, illus., tables, 1966.

Clay minerals, analyzed by X-ray diffraction, are related to probable climatic and weathering conditions and to known or inferred paleogeographic relations. Analyses of samples from the Molas, Belden, and Minturn Formations are given for five locations in the Eagle basin of west-central Colorado, and from the Glen Eyrie and Fountain Formations at nine locations along the Rocky Mountain front between Colorado Springs, Colo., and Granite Canyon, Wyo. Comparison of the clay mineral composition from these rocks suggests that the climate became progressively more arid through Pennsylvanian time.—E.K.M.

4148 **Ray, Louis L.; Schultz, C. B.; Tanner, L. G.; Whitmore, F. C., Jr.; Crawford, Ellis.** Kentucky, *in* Guidebook for Field Conference G, Great Lakes–Ohio River valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 53–63, illus., 1965.

The Ohio River, in the glaciated sector between Cincinnati, Ohio, and Madison, Ill., flows for 86 miles in a narrow, steep-walled valley 400 feet or more below a dissected upland of low relief. Alluvium, largely glacial outwash, fills the deep bedrock channel to a depth of 200 feet, with remnants of three terraces above the flood plain. Of the four main Quaternary ice sheets, only the Wisconsin failed to reach Kentucky. South of the Ohio River, mantling drifts of Nebraskan, Kansan, and Illinoian age are seen on the uplands, dissected by the tributary Kentucky River drainage. They are often deeply weathered, and in places thinly blanketed with Wisconsin loess. A composite section is given.—G.D.C.

4194 **Reed, James Stalford.** An investigation of the constitution of transition metal ions in a spinel matrix [abs.]: Dissert. Abs., v. 26, no. 7, p. 3623, 1966.

Rees, Antony L. *See* Ezell, Paul. 4168

Reeves, C. C., Jr. *See* Parry, W. T. 4326

Reso, Anthony. *See* Johnson, J. G. 4016

Rexroad, Carl B. *See* Nicoll, Robert S. 3992

4122 **Reynolds, Douglas W.** Relation of hydrocarbon accumulation to deltaic sedimentation in western Kentucky [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 633, 1966.

3995 **Reynolds, Ray T.; Fricker, Peter E.; Summers, Audrey L.** Effects of melting upon thermal models of the earth: Jour. Geophys. Research, v. 71, no. 2, p. 573–582, illus., tables, 1966.

Investigation into the problem of melting within the Earth strongly indicates that melting has taken place within the outer layers of the Earth at some time in the

Earth's history. Fluid convection should then have occurred and have been an efficient method of heat transfer. Numerical methods are developed for calculating the temperature distribution within a spherical body which melts according to a simple melting curve and which convects with the limiting case of high efficiency. These techniques are applied to mathematical models of the Earth's mantle. The calculations provide starting conditions for an approach to the problem of the differentiation of radioactive materials within the Earth.—Authors' abstract

Rhodehamel, Edward. *See* Richards, Horace G. 4088

4053 **Richards, Horace G.** INQUA Field Conference B–1, Central Atlantic Coastal Plain, *in* Guidebook for Field Conferences B–1 and B–3—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 5–28, illus., 1965.

The notes for this trip are brief because the stratigraphy is more detailed in the book "The Quaternary of the United States", prepared for this INQUA Congress (1965). Each of the several leaders has assisted in preparing the section of the guidebook dealing with his area—Long Island, New Jersey, Pennsylvania, Delaware, and Maryland. For the part dealing with Brandywine gravels, a portion of an abstract from a report by John T. Hack (1955) is quoted; this and other sections are individually cited.—G.D.C.

Richards, Horace G. *See* Upson, Joseph. 4087

4088 **Richards, Horace G.; Rhodehamel, Edward.** New Jersey, *in* Guidebook for Field Conference B–1, Central Atlantic Coastal Plain—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 10–15, illus., 1965.

A terminal moraine of Wisconsin age crosses the State from Perth Amboy to Belvidere. South of this lie discontinuous patches of two older drifts. South of these drift sheets, varying thicknesses of unconsolidated deposits of Tertiary or Cretaceous to Pleistocene age are exposed. These are described, especially the Cape May Formation. Pleistocene gravels show effects of Wisconsin frost heave. In chert pebbles are fossils of Silurian or Devonian age by which ancient channels of the Delaware River are postulated. On the sea floor 30 miles south of Cape May are boulders which may have been ice rafted to the glacial mouth of the Delaware.—G.D.C.

4297 **Richardson, W. E.** Oswego is prolific target in Oklahoma: Oil and Gas Jour., v. 63, no. 51, p. 96–100, 1965.

The Oswego limestone, the oldest unit of the Marmaton Group of Pennsylvanian age, is a shelf limestone over a wide area of northern Oklahoma. Along its southern limt this limestone is porous and produces oil.—S.E.F.

Richmond, G. M. *See* Denson, N. M. 3916

3917 **Richmond, G. M.; Murphy, J. F.; Denson, N. M.** Glacial chronology of the Wind River Mountains, Pt. C *in* Guidebook for Field Conference E, Northern and Middle Rocky Mountains—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 28–37, illus., table, 1965.

Three glaciations named by Blackwelder (1915) in this region have been subdivided and reclassified with new terminology. Deposits formerly considered Buffalo Till include multiple glaciations, the Bull Lake Glaciation has two distinct stades, and the Pinedale Glaciation three stades. The sequence of Quaternary glaciations in the Wind River Mountains, given here in a table, is a standard for correlation throughout the Rocky Mountains. Type deposits are visited between Lander and Pinedale, Wyo., and their relation to Pliocene erosion surface and margins of the late Pleistocene ice cap are observed.—G.D.C.

3918 **Richmond, G. M.; Mudge, M. R.; Lemke, R. W.; Fryxell, Roald.** Relation of alpine glaciation to the Continental and Cordilleran ice sheets, Pt. E *in* Guidebook

for Field Conference E. Northern and Middle Rocky Mountains—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 53–68, illus., 1965.

In the area between Butte, Mont., and Glacier National Park, lobes from the largest Pleistocene ice cap in the Rocky Mountains spread eastward onto the plain, locally in contact with the Continental ice sheet, and westward to merge with the Cordilleran ice sheet. No pre-Bull Lake deposits of the Continental ice sheet have been recognized east of the mountains in Montana, but there may have been a few Cordilleran ice invasions of that age in the Flathead Valley to the west. Several large lakes were impounded against the uplands; deposits of glacial lakes Cutbank and Missoula are visited, as well as various moraines and periglacial features. A sketch map shows the relation of the moraines east of Glacier National Park. G.D.C.

Richmond, G. M. *See* Fryxell, Roald. 3919

Richmond, G. M. *See* Bright, R. C. 4026

4027 **Richmond, G. M.; Fryxell, Roald; Weiss, P. L.; Neff, G. E.; Trimble, D. E.** Glacial Lake Missoula, its catastrophic flood . . ., and the loesses and soils of the Columbia Plateau, Pt. F *in* Guidebook for Field Conference E, Northern and Middle Rocky Mountains—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 68–89, illus., 1965.

Glacial Lake Missoula, which covered a large area of the Clark Fork River drainage, was impounded by successive advances of a Cordilleran ice lobe across Idaho in Bull Lake and Pinedale time, as were several other lakes in eastern Washington. Its sudden release by collapse of the waning ice dam resulted in enormous catastrophic floods across the Columbia Plateau and down river to the sea. This half-century old concept was not readily accepted although the scabland tracts, visited in this field conference, exhibit scour features, abandoned cataracts and depositional features which could only have been so produced. Recent work in the Spokane area dates such flooding as of early Pinedale age. Loesses and soils from other lake deposits, and evidences of changing post-glacial climates were also studied, notably the Marmes Rockshelter archeological site.—G.D.C.

Richmond, G. M. *See* Love, J. D. 4028

Richter, D. H. *See* Murata, K. J. 4172

Ridlon, J. B. *See* vonHuene, Roland. 3922

Rinehart, C. Dean. *See* Huber, N. King. 4340

Ritchie, E. J. *See* Weidie, A. E. 4092

Ritchie, Earl J. *See* Weidie, Alfred E. 4091

4266 **Ritter, Charles J.; Dennen, William H.** Blackening of natural quartz by γ irradiation: Am. Mineralogist, v. 51, nos. 1–2, p. 220–227, illus., 1966.

Quartz samples were irradiated by X-ray fluorescence, using a tungsten target. Strong blackening was attained by rhyolitic quartz, intermediate blackening by granitiz quartz, and little or no blackening in metamorphic and hydrothermal vein quartz. Rhyolitic quartz has a relatively low inversion temperature. Darkened quartz samples which were bleached by heating above their inversion temperature, and then irradiated, showed an increase in blackening.—M.L.L.

4014 **Riva, John.** Upper Levis graptolites from Cowansville, southern Quebec: Jour. Paleontology, v. 40, no. 1, p. 220–221, table, 1966.

A Lower Ordovician graptolite fauna (Levis zone D) is correlated with the upper zone of the Deepkill of New York, zone 9 of the Marathon region, West Texas, and the upper part of the Skiddaw Group of Britain.—R.E.G.

4123 **Robertson, Eugene C.** Compaction tests on aragonitic sediment [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 633, 1966.

Robinson, E. A. *See* Treitel, S. 4337

3903 **Robinson, Robert B.** Classification of reservoir rocks by surface texture: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 547–559, illus., tables, 1966.

A simple microscopic determination of the surface texture of a reservoir rock provides a ready and reliable means of evaluating its reservoir-performance properties. Results of standard laboratory tests for the porosity, permeability, and pore size distribution of some 2,000 samples of sandstone and carbonate rock were matched with types of rock surface textures, as determined by polished section–binocular microscope examination, and an empirical correlation was established between reservoir properties and visual rock characteristics. Some surface-texture characteristics are reviewed, common types of sandstone and carbonate rock are listed and discussed, and correlations are tabulated.—B.H.K.

Robinson, T. W. *See* Hunt, Charles B. 4084

3935 **Rogers, John J. W.** Coincidence of structural and topographic highs during post-Clarno time in north-central Oregon: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 390–396, illus., table, 1966.

Structurally high areas in north-central Oregon also were topographically high during and after extrusion of the Columbia River Group (middle Miocene).—A.E.R.

4013 **Rolfe, W. D. Ian; Denison, Robert H.** The supposed fish *Pseudodontichthys* Skeels, 1962, is the phyllocarid crustacean *Dithyrocaris*: Jour. Paleontology, v. 40, no. 1, p. 214–215, 1966.

Examination of specimens of topotypic *Pseudodontichthys whitei* Skeels (1962) reveals that these are not gnathal plates of a chondrichthyan fish but gnathal lobes of the mandibles of a phyllocarid crustacean.—F.C.W.

4341 **Rona, Peter A.; Clay, C. S.** Continuous seismic profiles of the continental terrace off southeast Florida: Geol. Soc. America Bull., v. 77, no. 1, p. 31–43, illus., table, 1966.

Six profiles traverse the continental terrace (shelf plus slope) and four additional profiles extend nearly across Florida Straits between lat 26° and 25° N. At 26° N. the terrace comprises a shelf of high-reflectivity material with scarp-like relief, probably limestone, and a dip slope of low-reflectivity sediment. At 25° N. shelf and slope are formed by a prograded tongue of low-reflectivity sediment. In between, a replacement series exists in which the sedimentary tongue progrades the limestone shelf. Mean shelf depth is maintained at 300±75 throughout the change in terrace composition and structure. Limestone shelf was identified beneath about 270 m of sediment (about 470 m below sea level); the gradient along the limestone shelf surface at about 2.5 m/km to the south appears fairly consistent with regional subsidence combined with local isostatic response to sediment load.—E.H.L.

3900 **Rooney, Lawrence F.** Evidence of unconformity at top of Trenton Limestone in Indiana and adjacent States: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 533–546, illus., 1966.

Subsurface data in Indiana and adjacent states indicate subaerial erosion of the Trenton Limestone, karst topography and large solution cavities in the upper part, and a regional unconformity between it and overlying shale of Cincinnatian age. The Trenton Limestone thins southeastward across Indiana and terminates along a major northeast-trending structural alinement. This alinement, marked by the eastern border of the Ozarks in Missouri, the Findlay arch in Ohio, and the St. Lawrence River valley, was a zone of structural inflection during Trenton time. East of this hinge line, contemporaneous deposition (of the Lexington and Cynthiana Formations) continued into Cincinnatian time without interruption.—B.H.K.

4074 **Rothwell, W. T., Jr.** Stratigraphic facies prediction and recognition in young offshore basins from studies of fossil environments [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 650, 1966.

4003 **Rowe, M. W.; Bogard, D. D.** Xenon anomalies in the Pasamonte meteorite: Jour. Geophys. Research, v. 71, no. 2, p. 686–687, illus., table, 1966.

The largest anomalies ever observed in the mass region 131 to 136 are seen in the xenon from Pasamonte II. Results of a second analysis of Pasamonte are reported, which confirm the findings of Rowe and Kuroda (1965). The data are consistent with spontaneous fission of Pu-244 as the main source of excess Xe, but not with spontaneous fission of Cm-247, neutron-induced fission of U-235, or photofission of U-238.—D.B.V.

Rubin, Meyer. *See* Fryxell, Roald. 3919

Rubin, Meyer. *See* Bright, R. C. 4026

4145 **Ruhe, R. V.** The Iowa Quaternary, *in* Guidebook for Field Conference C, Upper Mississippi Valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 110–126, illus., tables, 1965.

Iowa is a classic region of continental glaciation. Type localities of note are near Afton Junction, Yarmouth, and Loveland. Pre-Wisconsin drifts and loesses are confined generally to the southern half of the state, and Wisconsin drifts to the northern half. On uplands and high-level terraces, Wisconsin loess is the surface deposit throughout the state, except for the Des Moines drift from Minnesota. In this field conference the stratigraphy is studied, and radiocarbon ages of various tills and loesses are given.—G.D.C.

4075 **Rusnak, Gene A.** Continental margin of northern and central California [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 650–651, 1966.

4133 **Rvachev, V. D.** Topographic relief and bottom sediments of the Georges and Banquereau Banks [translated from Russian (1964) by E. R. Hope]: Canada Defence Research Board Directorate Sci. Inf. Services [Rept.] T 436 R, 7 p., illus., 1965.

Bathymetric and bottom-sediment charts have been compiled from data collected by Russian expeditions over these fishing banks, with the use of some American data. Both banks lie at the edge of the continental shelf, the Georges Bank southeast of Cape Cod, and the Banquereau Bank off the Nova Scotia peninsula. The surfaces of each are briefly described and compared along with adjacent depressions and submarine channels. The sorting and color variations of the sediments differ, as well as the size distribution, due not only to reworking but also to their origin in relation to the Quaternary glaciation. The Pleistocene ice played a great role not only on land but on the adjacent shelf, particularly in the northwest part of Georges Bank.—G.D.C.

4335 **Rye, Robert Orph.** The carbon, hydrogen, and oxygen isotopic composition of the hydrothermal fluids responsible for the lead-zinc deposits at Providencia, Zacatecas, Mexico [abs.]: Dissert. Abs., v. 26, no. 7, p. 3869, 1966.

4124 **Saito, Tsunemasa; Lidz, Louis.** Biostratigraphy of Blake Plateau (Atlantic) drill-hole samples [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 633, 1966.

4310 **Saito, Tsunemasa; Ewing, Maurice; Burckle, Lloyd H.** Tertiary sediment from the Mid-Atlantic ridge: Science, v. 151, no. 3714, p. 1075–1079, illus., tables, 1966.

Lower Miocene microfossils occur in basaltic glass in two dredge hauls from the crestal area of the Mid-Atlantic Ridge near 30° N. From the ridge and adjoining abyssal hills 43 pre-Pleistocene cores were identified, including one Cretaceous and four Eocene. Dredgings and cores now available suggest that the upper layer of the crust of the ridge is constructed of layers of interbedded sediments and basalt

flows. The data rule out the possibility of large-scale continental drifting or spreading of the ocean floor since the Lower Miocene.—Authors' abstract

3927 **Sangster, D. F.; Hood, P. J.; Gross, G. A.** Relationship between geology and geophysical parameters of a magnetite iron-formation: Canadian Mining and Metall. Bull., v. 59, no. 646, p. 154–158, 1966.

Detailed geologic and topographic mapping was carried out in conjunction with detailed magnetic, seismic, and electromagnetic surveys. Oriented drill cores were obtained for magnetic polarization studies. Vertical-force magnetic anomalies within individual rock units showed a strong positive correlation with topographic relief. Moreover, magnetic intensity was found not to be quantitatively proportional to the magnetite content due to the presence of high remanent magnetization of the magnetite. Remanent polarization direction was subparallel to the plunge of the fold structure and mineral lineation in associated rocks. Results of the EM survey were inconclusive. Longitudinal seismic wave velocities, measured parallel to the bedding in magnetite-quartz iron-formation, ranged from 10,600 to 14,500 fps. Seismic velocity appears to increase with an increase in deformation of the rocks.—*from* Authors' abstract

4215 **Sangster, Donald Frederick.** The contact metasomatic magnetite deposits of southwestern British Columbia [abs.]: Dissert. Abs., v. 26, no. 7, p. 3869, 1966.

4331 **Sargent, K. A.; Luft, S. J.; Gibbons, A. B.; Hoover, D. L.** Geologic map of the Quartet Dome quadrangle, Nye County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ-496, scale 1:24,000, sections, 1966.

3890 **Sartenaer, Paul.** Refonte du genre *Pugnoides* Weller, S., 1910 (Rhynchonelloidea) [with English and Russian abs.]: Belgique Inst. Royal Sci. Nat. Bull., v. 40, no. 12, 10 p., illus., 1964.

Transverse serial sections have shown internal structures previously overlooked in *Pugnoides ottumwa* type species, resulting in a new definition of the genus, a modified stratigraphic extension (was Devonian-Triassic, now tentatively Mississippian-Pennsylvanian), the separation of many species formerly assigned to *Pugnoides*, and reevaluation of analogies with genera considered closely related. The type species was studied from hypotype material from the Pella beds of the Ste. Genevieve Limestone, Mississippian, Marion County, Iowa.—V.M.J.

4032 **Sartenaer, Paul.** Trois nouveaux genres de brachiopodes rhynchonellides du Famennien [with English and Russian abs.]: Belgique Inst. Royal Sci. Nat. Bull., v. 41, no. 3, 12 p., illus., 1965.

Three new genera of Famennian (late Upper Devonian) rhynchonelloid brachiopods are proposed. *Gastrodetoechia* is based on type species *Leiorhynchus utahensis* Kindle, E. M., 1908, from Jefferson Limestone equivalent (or younger beds) at Paradise, Utah; it also occurs in Idaho, Montana, Alberta, and Northwest Territories. *Megalopterorhynchus* is based on type species *M. haynesi* n. sp. from the upper Palliser Formation in Banff National Park, Alberta; it also occurs in Montana. *Evanescirostrum* is based on type subspecies *Nudirostra gibbosa seversoni* McLaren, D. J., 1954 (here elevated to species, *E. seversoni*) from the Palliser Formation in the Banff region.—V.M.J.

4181 **Saunders, W. Bruce.** Shale-limestone alternation in the upper portion of the Fayetteville Formation near Marshall, Arkansas: Arkansas Acad. Sci. Proc., v. 19, p. 81–87, illus., 1965.

The upper portion of the Fayetteville is the product of complex cyclic changes. Shale which composes 69 percent of the measured section, is the same in appearance from bottom to top, but its carbonate content differs markedly, increasing from lower to upper units. The section also contains lithographic limestone; fine-grained limestone; oolitic, phosphatic, and bioclastic limestone; and pellet phosphorite. The presence of phosphorites and lithographic limestones indicates a shallow, protected marine environment.—E.S.L.

4216 **Schaber, Gerald Gene.** Mineralogy and crystal chemistry of the sulfosalt minerals—Bournonite, seligmannite, aikinite, diaphorite and freieslebenite [abs.]: Dissert. Abs., v. 26, no. 7, p. 3870, 1966.

4134 **Schaeffer, Bobb.** The role of experimentation in the origin of higher levels of organization: Systematic Zoology, v. 14, no. 4, p. 318–336, illus., 1965.

The transition from one higher level of organization to another always involves some form of biological improvement for the same or a new way of life. The transition is usually expressed in terms of similar (broad) adaptations that evolve more or less in parallel in lineages of common ancestry. Shark evolution is divided into three levels, and the adaptations characterizing them are discussed. The history of the rodents also demonstrates experimentation on a grand scale. Experimentation is limited by ancestry, by selection, and particularly by the canalization of morphogenesis. The relationship between experimentation and multiple origins is discussed.—E.S.L.

Schafer, J. P. *See* Hartshorn, J. H. 4171

Scharon, LeRoy. *See* Hays, Walter W. 3905

3932 **Schleh, E. E.** Review of sub–Tamaroa unconformity in Cordilleran region: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 269–282, illus., 1966.

From a study of published reports it is concluded that a widespread unconformity exists near the Devonian–Mississippian boundary in the Cordilleran region of the western United States. This unconformity is interpreted as being the lower boundary of the Tamaroa Sequence.—W.C.C.

4125 **Schmalz, Robert F.** Role of kinetics in early diagenesis of carbonate sediments [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 633–634, 1966.

4315 **Schmidt, Robert George.** Preliminary geologic map of the Comb Rock quadrangle, Lewis and Clark County, Montana: U.S. Geol. Survey Misc. Geol. Inv. Map I-468, scale 1:24,000, sections, 1966.

4045 **Schmitter, Eduardo.** Carl Fries, Jr. (1910–1965): Am. Assoc. Petroleum Geologists Bull., v. 49, no. 12, p. 2318–2320, portrait, 1965.

4126 **Scholl, David W.; Johnson, William L.** Early post-depositional preservation of paleosalinity, a mathematical approach [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 634, 1966.

Schultz, C. B. *See* Ray, Louis L. 4148

3934 **Scott, Robert W.** New Precambrian(?) formation in Kansas: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 380–384, illus., table, 1966.

The thick sequence of pre–Upper Cambrian feldspathic sandstone and shale in central Kansas is here named the Rice Formation. Four drill holes in Rice County are designated as representative wells. The age of the Rice Formation is tentatively regarded as Precambrian(?).—A.E.R.

4039 **Seiglie, George A.** Notas sobre tres *Lepidocyclinas* de Cuba: Oriente Univ. Inst. Oceanog. Bol., v. 4, no. 1, p. 191–213, illus., 1965.

Lepidocyclina (Lepidocyclina) yurnagunensis yurnagunensis Cushman, *L. (L.) yurnagunensis morganopsis* Vaughan, and *L. (L.) giraudi* R. Douvillé are described. The Oligocene age and the environment of each of the three subspecies from Cuba are shown.—G.D.C.

4023 **Sharma, Ghanshyam D.** Geology of Peters Reef, St. Clair County, Michigan: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 327–350, illus., tables, 1966.

Peters Reef, one of several oil fields on the southeast side of Michigan basin within the Engadine Dolomite of uppermost Middle Silurian, was studied by means of well cuttings and logs. The reef is 1 3/4 mi long, 1 mi wide, about 350 feet high, and complex with core, back reef, and steeply dipping fore-reef facies. The main part was produced by organisms growing in situ. Original calcium carbonate was replaced by dolomite which altered the reef and organic structures but did not increase porosity appreciably; porosity is due to solution openings, formed during periods of erosion, and to fractures. Evaporites characterize post-reef sedimentation. Oil pool is sealed by anhydrite, and source beds are assumed to be underlying shales of the Clinton Group. Initial oil production is 2,500 b.p.d. plus.—S.P.S.

4127 **Sharma, Ghanshyam D.** Diagenesis and geochemistry of sediments in marine environment [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 634, 1966.

3915 **Shea, D. N.** West area of Edison oil field: California Div. Oil and Gas, California Oil Fields—Summ. Operations, v. 51, no. 1, p. 23–27, illus., table, 1965.

The sedimentary section in the West area of Edison oil field varies in thickness from 4,000–6,800 feet, ranges in age from Recent to lower Miocene, and overlies a schist of Jurassic(?) age that is considered to be basement in this area. The structure is homoclinal, gently dipping about eight degrees to the southwest, and is complicated by normal faulting. There are eight producing zones in the West area, but most oil has been from the Chamac (Mio–Pliocene) and Santa Margarita (upper Miocene) zones.—M.C.M.

4217 **Sheridan, Michael Francis.** The mineralogy and petrology of the Bishop Tuff [abs.]: Dissert. Abs., v. 26, no. 7, p. 3870–3871, 1966.

4304 **Shinn, E. A.** Coral growth-rate, an environmental indicator: Jour. Paleontology, v. 40, no. 2, p. 233–240, illus., tables, 1966.

Branching hermatypic corals, *Acropora cervicornis* (Lamarck) were transplanted into two areas of the Florida reef tract where they do not normally grow. The growth-rate of these corals and a control group on a thriving reef was measured twelve times between December 1960 and February 1962. Average growth-rate of the transplanted corals was less than one half that of the control group, which grew at 10 cm per year. Growth-rates, however, showed considerable variation. During a 2-month period one transplanted group grew as fast as the control group, but after 10 months died when the water temperature dropped to 13.3°C. Seasonal fluctuations in growth at all stations could be correlated in a general way to temperature fluctuations . . . Growth was greatest between 28° and 30°C. The results suggest that the method may be used as a standard ecological tool for determining growth tolerances of other reef-building organisms.—Author's abstract

Siever, Raymond. *See* Melson, William G. 4042

4128 **Siever, Raymond.** Mud into shale—When and how? [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 635, 1966.

4321 **Simpson, D. R.** Effects of magnesium on the formation of apatite: Am. Mineralogist, v. 51, nos. 1–2, p. 205–209, tables, 1966.

Apatite is formed by reacting 0.3M K-phosphate solution of pH 7.82 with calcite, calcite-dolomite mixture, and natural high Mg-calcite. With Na-phosphate solution, dolomite fails to react even in 10 months, dolomite+calcite results in an octacalcium phosphate and possible apatite, and calcite results in apatite. The presence of Cl^- and F^- permits apatite formation under more acid conditions; the effect of F^- is greater.—E.Z.

4270 **Simpson, Howard E.** Bedrock geologic map of the New Britain quadrangle, Connecticut: U.S. Geol. Survey Geol. Quad. Map GQ-494, scale 1:24,000, section, 1966.

4241 **Simpson, Robert B.** Radar, geographic tool: Assoc. Am. Geographers Annals, v. 56, no. 1, p. 80–96, illus., 1966.

Examination of representative and recently declassified samples of imagery from the type of radar developed especially for reconnaissance and mapping purposes by the military, the Side-Looking Airborne Radar ("SLAR"), indicates that SLAR images look very much like medium-grade aerial photos and will serve the following types of geographic tasks even better: those which require an overview of subcontinental magnitude, an overview in which careful timing is critical, and an overview with maximum economy of time and money.—*from* Author's abstract

4046 **Skeeters, W. W.** William Thomas Nightingale (1897–1964): Am. Assoc. Petroleum Geologists Bull., v. 49, no. 12, p. 2320–2321, portrait, 1965.

4036 **Slaughter, Bob H.** The Moore Pit local fauna—Pleistocene of Texas: Jour. Paleontology, v. 40, no. 1, p. 78–91, illus., 1966.

Slaughter et al. (1962) previously described several Pleistocene vertebrate local faunas from separate commercial pits in the second (T-2) terrace above the floodplain of the Trinity River at Dallas, Tex. Since that time, extensive commercial excavation has joined several of these pits. As it is now possible to trace the various levels from one to the other and as a scientific excavation at the Moore Pit has produced every species known from the other localities, all are brought under a single assemblage. The age of this assemblage is known to be in excess of 37,000 years, but falls within an old valley fill believed to have formed between 50,000 and 25,000 B.P. (Before Present). A complete and extended faunal list is included although only the new material is described. The climatic inference of the fauna and its significance to other related faunal assemblages is discussed.—Author's abstract

4065 **Slaughter, M.** Chemical bonding in silicate minerals—Pt. 1, Model for determining crystal-chemical properties: Geochim. et Cosmochim. Acta, v. 30, no. 3, p. 299–313, illus., tables, 1966.

Relations between chemical bond type and configuration and expected physicochemical behavior of the silicates are outlined. It is shown that covalent and overlap repulsive energies may be largely omitted when deducing some stability relations of minerals. The stability relations of some minerals can be predicted quantitatively by combining Coulomb energies with appropriate corrections. Melting temperatures of spinel calculated from the binding energies show exceptionally good agreement with observed melting points when covalency, radius-ratio, and coordinate-effect corrections are made to the melting points determined from Coulomb binding energies.—D.B.V.

4066 **Slaughter, M.** Chemical bonding in silicate minerals—Pt. 2, Computational methods and approximations for the binding energy of complex silicates: Geochim. et Cosmochim. Acta, v. 30, no. 3, p. 315–322, illus., 1966.

Methods have been generated and evaluated for the calculation of the electrostatic binding or partial binding energy of silicate minerals. Computational techniques used for finding the Coulomb energy and its derivatives are the Ewald method for lattice sums and differential Fourier synthesis. Computations are carried out for all symmetrically independent atoms in the unit cell. Repulsion energies and their derivatives are calculated using simple exponential repulsion terms. Covalency in the bonds is taken into account by reducing charges on ions for the Coulomb energy terms. By using differentials of energy terms, equations are given for shifting atoms to minimum energy positions.—Author's abstract

4067 **Slaughter, M.** Chemical bonding in silicate minerals—Pt. 3, Application of energy calculations to the prediction of silicate mineral stability: Geochim. et Cosmochim. Acta, v. 30, no. 3, p. 323–339, illus., tables, 1966.

Using the models and methods described in parts 1 and 2 of this series, the thermal stabilities of some phyllosilicates are predicted semiquantitatively. Calculated energies show that the stability of montmorillonite with respect to other phyllosilicates in most low temperature geochemical environments is probably the

results of hydration of the inter-layer space. Also, when small amounts of magnesium are present in a silicate system, montmorillonite is the phase which minimizes the total energy of the system.—D.B.V.

Sliter, W. V. *See* Douglas, Robert. 4157

4293 **Smiley, Charles J.** Cretaceous floras from Kuk River area, Alaska—Stratigraphic and climatic interpretations: Geol. Soc. America Bull., v. 77, no. 1, p. 1–13, illus., tables, 1966.

Cretaceous coastal plain plant-bearing deposits 4,250 feet thick in a broad east-trending synclinorium contain five sequential floras, representing major vegetation types. Collections from 40 localities were studied. All plant taxa have limited stratigraphic range. Correlations with intertonguing marine and nonmarine strata in Chandler-Colville Rivers region to the east indicate range in age from Middle Albian to Coniacian. Rapid transition from gymnosperm-dominated floras in older beds to angiosperm-dominated floras in younger beds took place in late Cenomanian to early Turonian time, coincident with unconformity reported in Chandler-Colville region. Comparisons of taxa with living analogs suggest that the Arctic Alaska Coastal Plain climate changed from warmer to cooler during this 30 million year span of Mesozoic time.—E.H.L.

Smith, D. K. *See* Newkirk, H. W. 4289

3937 **Smith, Derrell A.** Theoretical considerations of sealing and non-sealing faults: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 363–374, illus., table, 1966.

Theoretically, petroleum traps in preferentially water-wet (hydrophilic) rock depend on the capillary properties of the rocks, hydrocarbons, and water involved. The boundary of a reservoir rock is a barrier to hydrocarbon migration because displacement pressure of boundary rock exceeds displacement pressure of reservoir rock. The differential (capillary) pressure between hydrocarbons and water in the reservoir rock varies directly with thickness of the hydrocarbon column; when and where capillary pressure exceeds difference in displacement pressure, migration of excess hydrocarbons results; these variables determine trapping capacity of the boundary. Fault boundaries are subject to these same variable conditions which determine the degree to which a fault is sealing or non-sealing. Hypothetical examples are discussed.—B.H.K.

Smith, R. J. *See* Nielsen, John P. 3993

Smith, S. T. *See* Dougherty, E. L. 4238

4054 **Sonnenfeld, Peter.** Low-angle regional unconformities [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 635, 1966.

Souther, J. G. *See* Baer, A. J. 4276

4076 **Spaulding, Arthur O.** Oil and the asphalt jungle, Pt. 2 [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 651, 1966.

Speakman, K. *See* Carpenter, A. B. 4291

4218 **Spieker, Andrew Maute.** Hydrogeologic aspects of an analog model study of the Fairfield-New Baltimore area, Ohio [abs.]: Dissert. Abs., v. 26, no. 7, p. 3871, 1966.

4055 **Sproule, J. C.** Geology of Arctic islands [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 635–636, 1966.

4041 **Staatz, Mortimer H.; Albee, Howard F.** Geology of the Garns Mountain quadrangle, Bonneville, Madison, and Teton Counties, Idaho: U.S. Geol. Survey Bull. 1205, 122 p., illus., tables, geol. map, 1966.

The Garns Mountain quadrangle is an area of 215 sq mi at the north end of the Idaho–Wyoming thrust belt. Stratigraphy and structure are discussed, and the present and potential economic possibilities of phosphate and coal deposits are examined. The widespread Paleozoic and Mesozoic rocks have a total thickness of as much as 18,000 feet and are divided into 23 formations of Middle Cambrian to Late Cretaceous ages. Mesozoic sequences are about three times as thick as Paleozoic. Dominant structures in the Snake River Range are thrust faults with northwest trend and southwest dip; the Snake River Plain is a graben filled with horizontal or gently dipping rocks. Phosphate rock is confined to the Phosphoria Formation and coal occurs in the upper Frontier Formation in the Horseshoe Creek district.—V.S.N.

4056 **Stanley, Daniel J.** Graded flood deposits and turbidites—Comparison and significance [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 636, 1966.

4057 **Stanton, E. C., Jr.** Morrow County, Ohio—Case history of exploration and production [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 636, 1966.

4005 **Stanton, Robert J., Jr.** Megafauna of the upper Miocene Castaic Formation, Los Angeles County, California: Jour. Paleontology, v. 40, no. 1, p. 21–40, illus., table, 1966.

About 100 species, mostly pelecypods and gastropods, with smaller numbers of scaphopods, brachiopods, echinoderms, barnacles, bryozoans and vertebrates occur in the Castaic, many of them farther south than previously reported in the upper Miocene. Many of the Castaic taxa also are found in the Recent Panamanian Molluscan Province, indicating that the Castaic Formation was deposited near the northern limit of the late Miocene equivalent of that province.—R.E.G.

Statler, Anthony T. *See* Forgotson, James M., Jr. 3899

Steece, Fred V. *See* Tipton, Merlin J. 4186

4330 **Stewart, D. B.; Walker, G. W.; Wright, T. L.; Fahey, J. J.** Physical properties of calcic labradorite from Lake County, Oregon: Am. Mineralogist, v. 51, nos. 1–2, p. 177–197, illus., tables, 1966.

Calcic labradorite phenocrysts from basalt in Lake County, Oreg., are described and analyzed in detail. Crystals have unzoned cores (at least 90 percent of volume) and rims complexly zoned toward more sodic composition; structural state is high–intermediate. Analyzed composition is An 67.2, Ab 31.5, Or 1.3 (mol percent). Optical properties, specifc gravity, unit cell parameters, molar volume and indexed powder diffraction data are given. Cell edges, linear and volume expansion were determined for 10 temperatures up to 1141°C. Results indicate a possible reversible high–order transformation between 650 and 1050°C, which may be a change from body–centered to C–centered lattice. Such high temperature X–ray data is necessary to define the phase equilbrium diagram for calcic plagioclases.—B.C.H.

Stockton, Douglas. *See* Allen, D. R. 4099

Stone, J. E. *See* Wright, H. E., Jr. 4187

4077 **Story, Richard F.** Middle Ground Shoal field, Alaska [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 651, 1966.

4236 **Strangway, D. W.; Holmer, R. C.** The search for ore deposits using thermal radiation: Geophysics, v. 31, no. 1, p. 225–242, illus., table, 1966.

Kennecott Copper Corporation has conducted several months of airborne infrared work in an attempt to detect patterns related to geology or the presence of oxidizing sulfides. The results encountered have shown that certain microclimatological effects are very important. Among these are the hill effect shown by small topographic features bathed in warm air under thermal inversion conditions. Major faults are

evidently reflected in some cases as are areas of subterranean hot water. These observations have been confirmed by ground temperature measurements in holes two to three feet deep.—Authors' abstract

4338 **Strimple, H. L.; Knapp, W. D.** Lower Pennsylvanian fauna from eastern Kentucky—Pt. 2, Crinoids: Jour. Paleontology, v. 40, no. 2, p. 309–314, illus., table, 1966.

Recently acquired crinoids from the Pottsvillean Series of eastern Kentucky demonstrate a close relationship with species from the Morrowan Series of Oklahoma, Arkansas and Texas. Three forms are identifed from the Kendrick beds, Breathitt Formation, as *Paragassizocrinus* cf. *P. disculus* Strimple, *P.* cf. *P. turris* Strimple, formerly known only from the Wapanucka Limestone, and *Metacromyocrinus oklahomensis* (Moore and Plummer), previously reported from the Bloyd Formation, Wapanucka Limestone, and basal part of the Marble Falls Limestone. A new species is *Paragassizocrinus kendrickensis*. The genus *Diphuicrinus* Moore and Plummer is redefined on the basis of additional information, and *D. patina* n. sp. is described. A new family, Diphuicrinidae, is proposed. Authors' abstract

Stross, F. H. *See* Johnson, Ralph A. 4082

Summers, Audrey L. *See* Reynolds, Ray T. 3995

4058 **Swann, David H.; Buschbach, T. C.; Atherton, Elwood; Frye, J. C.** Cambrian and Ordovician oil potential of Illinois basin [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 636, 1966.

Tabor, R. W. *See* Crowder, D. F. 4273

Tanner, L. G. *See* Ray, Louis L. 4148

4129 **Tappan, Helen; Loeblich, Alfred R., Jr.** Foraminiferal remains in palynological preparations [with French abs.]: Rev. Micropaléontologie, v. 8, no. 2, p. 61–63, 1965.

Acid-treated palynologic preparatins of marine rocks frequently contain foraminiferal remains that are either fluorite replacements of the original calcite tests, or chitinous membranes. Literature on the latter is reviewed. These inner linings are not specifically determinable in many cases, and some mistaken identifications are discussed.—E.S.L.

4059 **Tappan, Helen N.; Lipps, Jere H.** Wall structures, classification, and evolution in planktonic Foraminifera [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 637, 1966.

4262 **Tatlock, D. B.** Some alkali and titania analyses of tektites before and after G–1 precision monitoring: Geochim. et Cosmochim. Acta, v. 30, no. 1, p. 123–128, illus., 1966.

A comparison of 55 older analyses of Australasian tektites with 110 modern precisely monitored analyses suggests that more than half the older alkali and titania determinations are decidedly inaccurate and misleading. Deviations of the older analyses from the restricted values of the modern analyses are comparable to the imprecisions shown by early analyses of G–1 granite and W–1 diabase. This suggests that a high percentage of older alkali and titania analyses, such as those of Washington's tables [1917], are of questionable quality.—Author's abstract

4193 **Tauson, L. V.** Factors in the distribution of the trace elements during the crystallization of magmas, *in* Physics and chemistry of the Earth, V. 6: New York, Pergamon Press, p. 215–249, tables, 1965.

Analysis of the distribution of trace elements in igneous rock minerals and the form in which they occur in rocks shows that the concept of an exclusively diadochic distribution of trace elements, varying only with size and charge of interchanging

ions, does not give an objective picture. The diadochic distribution of natural dispersed elements, accessory elements, and ore elements is in part determined by such factors as crystal chemical properties of interchanging elements, conditions of crystallization of minerals, and structure and composition of minerals taking up diadochic impurities. Non-diadochic distribution of ore elements may be determined by composition and conditions of crystallization of magma, break-down of diadochic mixtures, and nature of sorptive processes during crystallization of silicate melts.—V.S.N.

4078 **Taylor, Donald M.** Project Mohole [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 651–652, 1966.

Taylor, H. F. W. *See* Carpenter, A. B. 4291

Tebbutt, Gordon E. *See* Ebanks, William J., Jr. 3953

4060 **Teichert, Curt.** Era boundaries reconsidered [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 637, 1966.

Tenney, Charles S. *See* Berg, Robert R. 3943

4021 **Tenney, Charles S.** Pennsylvanian and Lower Permian deposition in Wyoming and adjacent areas: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 227–250, illus., 1966.

Location of land areas and depositional basins are interpreted from distribution of lithofacies and thickness of Pennsylvanian and Lower Permian rocks. Principal Early Pennsylvanian positive elements were the Ancestral Front Range, Black Hills and Chadron arch, Transcontinental arch, Rosebud arch, Bannock highland, and Pathfinder uplift. The sea transgressed between these positive elements onto the Wyoming shelf from both southeast and southwest. Terrigenous sediments, derived chiefly from the Ancestral Front Range, tongue basinward into carbonate and evaporite rock and are thickest in the Powder River basin and Lusk embayment. An additional area of uplift is recorded in central Wyoming in Middle Pennsylvanian and Early Permian but otherwise the depositional patterns were similar until Middle Permian when deposition became dominated by a transgression from the west. E.K.M.

4298 **Thames, C. B., Jr.** Oil hunters look at east Williston: Oil and Gas Jour., v. 64, no. 10, p. 128–130, 1966.

Combinations of stratigraphic traps, regional plunging noses, and low relief structural elements offer a "happy hunting ground to the diligent explorationist" on the east side of the Williston basin, where large blocks of land can be leased reasonably and where there is an all-weather road network.—C.A.S.

3925 **Thode, H. G.; Monster, J.** Sulfur-isotope geochemistry of petroleum, evaporites, and ancient seas, *in* Fluids in subsurface environments—A smposium: Am. Assoc. Petroleum Geologists Mem. 4, p. 367–377, illus., tables, 1965.

Bacterial reduction of sulfate is largely responsible for the wide fluctuations in isotopic ratio of S 34 in marine sediments. Present day ocean water sulfate, remarkably uniform in sulfur-isotope content, provides a base level from which fractionation can be reckoned. From a study of the sulfur-isotope distribution in marine evaporites of various Precambrian to Recent sedimentary basins of several continents, the sulfur-isotope ratio for the various ancient oceans has been estimated and a pattern of change established for petroleum sulfur throughout geologic time. Evidence points to sea sulfate of the sedimentary basins as the original source of petroleum sulfur.—G.D.C.

4243 **Thrailkill, John Vernon.** Studies in the excavation of limestone caves and the deposition of speleothems—Pt. 1, Chemical and hydrologic factors in the excavation of limestone caves—Pt. 2, Water chemistry and carbonate speleothem relationships in Carlsbad Caverns, New Mexico [abs.]: Dissert. Abs., v. 26, no. 7, p. 3871–3872, 1966.

4226 **Thralls, Hugh M.** Geophysics and the changing world: Geophysics, v. 31, no. 1, p. 1–11, illus., 1966.

A rough analysis of the present trend of geophysics reveals that although petroleum prospecting is still dominant, the petroleum industry no longer holds the power of economic life or death over the average geophysicist; the scope of activity open to a well-trained geophysicist is widening day by day and opportunities are limited only by the individual's imagination.—D.B.V.

4239 **Thyssen-Bornemisza, Stephen.** Possible application of the anomalous free-air vertical gradient to marine exploration: Geophysics, v. 31, no. 1, p. 260–263, illus., table, 1966.

It can be assumed that lithologic unts of anomalous density below the sea floor may generate computable free-air vertical gravity gradients when vertical unit cylinder shapes or other mass forms are approximated. These anomalous gradients would pass undisturbed through sea water and could be measured over sufficiently large vertical intervals, using a suitable gravity meter. A technique for accomplishing this is proposed here; as suggested, it is restricted to the drilling locality, but it could be expanded into a more general technique with presently available instrumentation.—D.B.V.

4240 **Thyssen-Bornemisza, Stephen.** Correlating sea-surface and aerial gravity measurements: Geophysics, v. 31, no. 1, p. 264–266, illus., 1966.

The anomalous free-air vertical gradient when observed over a constant vertical interval in a combined aerial and surface profile establishes a measure of similarity between waveforms of gravity at different altitudes; this correlation technique would uncover variation in the upward continuation of sufficiently large anomalous fields if present. Proper selection of vertical intervals should help in discriminating gravity effects regarding depth and extent, which could include the study of isostatic or even subcrustal anomalies. The suggested correlated technique is especially useful in marine exploration, where conventional methods are not so readily available or successful, but of course could be applied also to continental surveys.—D.B.V.

4219 **Tidball, Ronald Richard.** A study of soil development on dated pumice deposits from Mount Mazama, Oregon [abs.]: Dissert. Abs., v. 26, no. 7, p. 3872–3873, 1966.

Tiffany, O. L. *See* Ebeoglu, D. B. 4064

4186 **Tipton, Merlin J.; Steece, Fred V.** Introduction to Pleistocene of Big Sioux River Basin in South Dakota, *in* Guidebook for Field Conference C, Upper Mississippi Valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 11–30, illus., 1965.

Interbedded glacial and interglacial deposits up to 710 feet thick, representing most of Pleistocene time, make up the Coteau des Prairies and are exposed in the valley of the Big Sioux River and its major tributaries. In eastern South Dakota the bedrock of Cretaceous marine sedimentary rocks and Precambrian quartzites and granites crop out locally. Measured sections of the Pleistocene deposits are presented, and their lithology and structure for the stratigraphic intervals in the localities visited are compared. The presence of volcanic ash shards and fossil mollusks assists in the age correlations.—G.D.C.

4235 **Tittle, C. W.; Allen, L. S.** Theory of neutron logging, [Pt.] 2: Geophysics, v. 31, no. 1, p. 214–224, illus., tables, 1966.

A new version of an analytical theory of epithermal neutron logging is developed by application of steady-state one-group diffusion theory to a central point neutron source in concentric cylindrical regions. . . . Application of the theory is made to (1) a theoretical justification of the dual spaced neutron method of gas location, and (2) a theoretical investigation of the effect of the rock matrix in clean limestone and sandstone. Additional flux groups and source energy groups are briefly discussed.—Authors' abstract

4061 **Towe, Kenneth M.; Cifelli, Richard.** Aspects of wall ultrastructure in some hyaline Foraminifera [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 638, 1966.

4079 **Traxler, J. D.** Elwood field [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 652, 1966.

4337 **Treitel, S.; Robinson, E. A.** Seismic wave propagation in layered media in terms of communication theory: Geophysics, v. 31, no. 1, p. 17–32, illus., 1966.

The problem of a normally incident plane P wave propagating in a system of horizontally layered homogeneous perfectly elastic plates is reformulated in terms of concepts drawn from communication theory (z transform). This formulation leads to a degree of insight that would otherwise be difficult to achieve. One of the most interesting properties of the model used is the fact that a layered medium bounded by a perfect reflector at depth is representable as a dispersive, all-pass system with positive phase lag.—D.B.V.

Trimble, D. E. *See* Fryxell, Roald, 3919

Trimble, D. E. *See* Richmond, G. M. 4027

4220 **Troell, Arthur Richard, Jr.** Sedimentary facies of the Toronto Limestone, lower limestone member of the Oread Megacyclothem (Virgilian) of Kansas [abs.]: Dissert. Abs., v. 26, no. 7, p. 3873, 1966.

4221 **Troelsen, Johannes C.** Geology of the Bonne Bay–Trout River area, Newfoundland [abs.]: Dissert. Abs., v. 26, no. 7, p. 3873–3874, 1966.

4288 **Truesdell, A. H.** Ion-exchange constants of natural glasses by the electrode method: Am. Mineralogist, v. 51, nos. 1–2, p. 110–122, illus., table, 1966.

The regular-solution model ion exchange constants of twelve natural and simulated natural glasses were measured by using these as membranes of glass electrodes. All the glasses showed the selectivity sequence $2H^{+} > 2K^{+} > 2Na^{+} > Ca^{++} \geq Mg^{++}$. In light of the Eisenman theory for glass electrodes, the selectivity behaviour is explained by the "anionic field strength" of the exchange sites. A positive correlation exists between the mono-monovalent and the di-divalent exchange constants, as required by theory. The chemical change of a glass upon weathering is largely determined by its ion exchange behaviour which in turn affects the resulting water chemistry.—E.Z.

4295 **Tuthill, S. J.** Earthquake origin of superglacial drift on the glaciers of the Martin River area, south-central Alaska: Jour. Glaciology, v. 6, no. 43, p. 83–88, illus., 1966.

Evaluation of photographs of the Martin River and the so-called Sioux glaciers taken from 1938 to 1964 indicates that rock slides, rock falls, and snow and rock avalanches are an important mechanism for accumulation of superglacial debris. Massive rock avalanches, believed to have been triggered by the March 27, 1964 earthquake, suggest that earthquakes are an especially effective means for delivery of unusually large masses of debris onto glaciers. If such earthquake-triggered avalanching is ignored, massive debris accumulations on a stagnant glacier terminus may be misinterpreted to have been developed largely in response to regional climatic change, and the time required for such accumulations may be unduly lengthened.—L.L.R.

4087 **Upson, Joseph; Richards, Horace G.** Long Island, *in* Guidebook for Field Conference B-1, Central Atlantic Coastal Plain—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 7–10, illus., 1965.

The two major moraines shown on Long Island are the Harbor Hill and the Ronkonkoma, probably of early or middle Wisconsin age underlain by the

Manhassett formation, also regarded as of Wisconsin age. Early interpretations are compared.—G.D.C.

4167 **Vail, P. R.; Wilbur, R. O.** Onlap, key to worldwide unconformities and depositional cycles [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 638–639, 1966.

vanAndel, Tjeerd H. *See* Melson, William G. 4042

3923 **Verniani, Franco.** The total mass of the Earth's atmosphere: Jour. Geophys. Research, v. 71, no. 2, p. 385–391, tables, 1966.

The total mass of the Earth's atmosphere, computed as precisely as possible from the present data on the atmospheric pressure and height distribution of the Earth's land, is $(5.136\pm0.007)\times10^{21}$ g. The total mass of each of the principal constituents of the atmosphere was also computed.—D.B.V.

vonderBorch, Christopher C. *See* Peterson, Melvin N. A. 4119

4189 **VonHerzen, R. P.; Langseth, M. G.** Present status of oceanic heat flow measurements, *in* Physics and chemistry of the Earth, V. 6: New York Pergamon Press, p. 365–407, illus., tables, 1965.

The steady heat flow per unit area through the ocean floor is nearly equivalent to that through the surface of continental regions. However, values of oceanic heat flow vary by more than one order of magnitude between extremes. The variations can be correlated with major geologic structures of the ocean floor, such as the high values related to oceanic rises. Some low values, however, seem to be related to the configurations and processes peculiar to sea floor environment and do not represent heat flow from the deep interior. Data from heat-flow measurements in the Indian Ocean since 1960 are summarized in tables and compared with results from other areas. It is concluded that there are no regional north-south or east-west variations in heat flow over the Indian Ocean as a whole.—V.S.N.

3922 **vonHuene, Roland; Ridlon, J. B.** Offshore gravity anomalies in the Santa Barbara channel, California: Jour. Geophys. Research, v. 71, no. 2, p. 457–463, illus., 1966.

Gravity measurements were made on four cruises in the Santa Barbara channel, the offshore extension of the Ventura basin, with a surface ship gravimeter. Navigational correction uncertainties often exceeded those of acceptable gravity measurements. The measured mean square discrepancy of the accepted measurements, evaluated at 147 crossings of the ship tracks, is 2.7 mgal. A westward extension and gradual shoaling of the Ventura basin is implied by an elongate gravity minimum flanked by a maximum which coincides with the Channel Islands. Diverging from this east-west structural grain is a pronounced northwest-trending gravity ridge.—D.B.V.

4121 **VonRad, Ulrich; Hesse, Reinhard.** Possible non-turbidite origin of deep-sea sands in Cretaceous flysch (Bavarian Alps, Germany) and Recent San Diego Trough (California) [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 632–633, 1966.

Wahrhaftig, Clyde. *See* Péwé, Troy L. 4316

Wainio, K. M. *See* Ebeoglu, D. B. 4064

Waler, Charles T. *See* Dennis, John G. 4245

4080 **Walker, Charles T.** Boron as paleosalinity indicator not affected by carbon in clay fractions [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 652, 1966.

Walker, G. W. *See* Stewart, D. B. 4330

4222 **Walters, Lawrence Albert.** Major and trace element studies of selected granitic pegmatites and their associated wall rocks in the Rumford District, Maine [abs.]: Dissert. Abs., v. 26, no. 7, p. 3874, 1966.

4089 **Ward, Porter E.; Hoffard, Stuart H.; Davis, Dan A.** Hydrology of Guam: U.S. Geol. Survey Prof. Paper 403-H, p. H1-H28, illus., tables, 1965.

Representative streams and character of runoff, occurrence of ground water in various types of rock, and the development of water resources and the chemical character of water on the Island of Guam are discussed. The northern half of Guam is a permeable limestone terrane with no stream flow; a fresh water lens floats on the heavier sea water, filling the limestone below sea level, and discharges at the shore. The southern part of the island is a volcanic complex of overall low permeability and deeply eroded by streams. The water table in this complex has high relief and discharge is diffused at many seeps and small springs, mostly along streams. Almost no water has been obtained from wells in this area.—V.S.N.

Washburn, A. L. *See* Hunt, Charles B. 4084

4252 **Wasson, B. E.** Source and development of public and industrial water supplies in northwestern Mississippi: Mississippi Board Water Commissioners Bull. 65-2, 86 p., illus., tables, 1965.

Principal aquifers in northwestern Mississippi are Mississippi River alluvium (Quaternary), and Wilcox Group, Tallahatta Formation, Sparta Sand, and Cockfield Formation of Tertiary age. Outcrops of the latter trend north-south and dip gently westward to the Mississippi embayment trough; their sediments are composed of sand, silt, clay, shale, lignite, and limestone. Every locality is underlain by at least one aquifer and in most there are several fresh-water artesian aquifers ranging from shallow to more than 2,000 feet. Water from shallow wells in all Tertiary aquifers generally has low pH, low dissolved solids, and high free carbon dioxide, and is usually soft to moderately hard. Yields of municipal and industrial wells developed in Tertiary sands are as great as 3,000 gpm, and in large wells screened in Mississippi River alluvium up to 5,000 gpm.—*from* Author's abstract

4147 **Wayne, William J.; Gooding, A. M.** Indiana, *in* Guidebook for Field Conference G, Great Lakes-Ohio River valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 26-53, illus., table, 1965.

Indiana has tills of the Kansan, Illinoian, and Wisconsin Stages, and interglacial sediments; fossiliferous silt beds determine extent of fluctuations. The classification used in Indiana is adapted largely from that of Illinois. The White River Sublobe of the Erie Lobe is the subject for study in western and central Indiana; the stratigraphy for southeastern Indiana is described separately. Deep valleys were extended northward from the Ohio River during and after Sangamon Interglacial time. Loess caps remnants of a Wisconsin valley train. Several geologic sections are shown.—G.D.C.

Weber, Florence. *See* Péwé, Troy L. 4316

4267 **Weber, Jon N.** Dehydration of diaspore at water pressures from 15 to 15,000 psi: Am. Mineralogist, v. 51, nos. 1-2, p. 235-238, illus., table, 1966.

The non-equilibrium dehydration curve for diaspore from Chester, Mass., is determined by the DTA method at various values of $P(H_2O)$. The dehydration temperature, between 500° and 600°C, is nearly independent of pressure, is independent of grain size, and is 150-200° above Kennedy's equilibrium curve. ΔH of dehydration is about 91 ± 7 cal/gm.—E.Z.

4092 **Weidie, A. E.; Murray, G. E.; Cameron, C. P.; Long, J. J., Jr.; Ritchie, E. J.** Stratigraphy and structure of Parras basin and adjacent areas of northeastern Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 639-640, 1966.

4091 **Weidie, Alfred E.; Cameron, Christopher P.; Long, John J., Jr.; Ritchie, Earl J.** Petrographic and chemical study of Yucatán carbonates [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 639, 1966.

4223 **Weis, Leonard Walter.** The origin of the Tigerton anorthosite [abs.]: Dissert. Abs., v. 26, no. 7, p. 3874–3875, 1966.

Weiss, P. L. *See* Richmond, G. M. 4027

4093 **Wheeler, Harry E.** Systematic interpretation of unconformities [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 640, 1966.

White, George W. *See* Goldthwait, Richard P. 4149

4224 **White, Richard William.** Ultramafic inclusions in basaltic rocks from Hawaii [abs.]: Dissert. Abs., v. 26, no. 7, p. 3875, 1966.

Whitmore, F. C., Jr. *See* Ray, Louis L. 4148

4094 **Whitten, E. H. T.** Quantitative approach to nature and areal variability of fold geometry [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 640, 1966.

4185 **Wicklein, Phillip; Carpenter, Alden B.** Report on some iron and nickel minerals from the soapstone deposits of Saline County, Arkansas [abs.]: Arkansas Acad. Sci. Proc., v. 19, p. 89, 1965.

Wiik, H. B. *See* Buseck, Peter R. 4303

Wilbur, R. O. *See* Vail, P. R. 4167

3926 **Wilde, Pat.** Estimates of bottom current velocities from grain size measurements for sediments from the Monterey deep-sea fan, *in* Ocean science and ocean engineering 1965—Joint Conf. Marine Technology Soc. and Am. Soc. Limnology and Oceanography, Trans., V. 2: Washington, D. C., Marine Technology Soc., p. 718–727, illus., table, 1965.

The equation $w = u\alpha$ was used to predict the grain size of sediment carried in the 1929 Grand Banks turbidity current. It is also possible to solve this equation for the downslope component of current velocity if the grain size and bottom slope are known. Current velocities obtained for the Monterey deep-sea fan off California are on the order of 10^1 to 10^2 cm per sec. This is somewhat higher than measured or computed for bottom currents, and lower than estimated for turbidity currents.—E.S.L.

3889 **Williams, B. G.; Greenland, D. J.; Lindstrom, G. R.; Quirk, J. P.** Techniques for the determination of the stability of soil aggregates: Soil Sci., v. 101, no. 3, p. 157–163, illus., 1966.

Four methods for determining the stability of soil aggregates were studied. Particular emphasis was given to the mode of aggregate disruption. A permeability method proved to be more versatile than wet-sieving and suspension-density methods. Turbidimetric determinations of suspension densities are particularly useful for studying small samples treated with synthetic stabilizing agents.—J.W.H.

3902 **Williams, Gordon D.** Origin of shale-pebble conglomerate: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 573–577, illus., 1966.

Shale pebble conglomerate was observed forming on the North and South Saskatchewan Rivers, Canada, by reworking of mud-cracked clay beds into sand bodies.—W.C.C.

Willman, H. B. *See* Frye, John C. 4144

Willman, H. B. *See* Frye, John C. 4146

4095 **Winder, C. Gordon.** Conodont zones and stratigraphic variability in Upper Devonian of Ontario [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 641, 1966.

Winder, Gordon C. *See* Lee, Pei-Jen. 3975

4322 **Wood, D. L.; Ballman, A. A.** Blue synthetic quartz: Am. Mineralogist, v. 51, nos. 1–2, p. 216–220, illus., 1966.

The spectral absorption curve determined for synthetic blue quartz with about 5.8 ppm cobalt by weight indicates that divalent Co is in a tetrahedral site. Inclusion of divalent Co in the lattice is non-uniform as shown by color banding seen in view parallel to optic axis. A different growth mechanism for the X and Z directions is suggested by lack of color of quartz grown along the X direction. Most ions do not fit easily into the quartz lattice; color is produced by very small amounts of cobalt because of its intense absorption.—B.C.H.

4049 **Woodward, A. F.** Dean A. Sheldon (1908–1965): Am. Assoc. Petroleum Geologists Bull., v. 49, no. 12, p. 2324–2325, portrait, 1965.

4051 **Woodward, Herbert P.** Morris Rones (1922–1965): Am. Assoc. Petroleum Geologists Bull., v. 50, no. 2, p. 401–403, portrait, 1966.

4081 **Wright, Frederick F.** Sedimentary regime of San Miguel Gap [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 652, 1966.

4187 **Wright, H. E., Jr.; Stone, J. E.; Cushing, J.; Matsch, C. L.** Introduction to glacial history of Minnesota, and General geology of the Minneapolis–St. Paul area, *in* Guidebook for Field Conference C, Upper Mississippi Valley—Internat. Assoc. Quaternary Research, 7th Cong., U.S.A., 1965: Lincoln, Nebr., Nebraska Acad. Sci., p. 30–56, illus., 1965.

Minnesota is covered almost entirely by Pleistocene deposits of Wisconsin age. Four ice lobes from different directions carried drift reflecting varying bedrock of this and adjacent states and Canada. The stratigraphic and geomorphic relations are easily deciphered by contrasting color and lithology, high relief, and perfection in diagnostic landforms. The field trip covers parts of drift areas of the Des Moines, Grantsburg, Wadena, and Superior Lobes, and the Twin Cities area where Ordovician rocks are exposed in the bluffs of the Mississippi and Minnesota Rivers. Here the Glacial River Warren carried discharge of Glacial Lake Agassiz and cut through thick drift into bedrock. Three named glacial formations in this area are described.—G.D.C.

Wright, T. L. *See* Stewart, D. B. 4330

York, Derek. *See* Macintyre, R. M. 4258

4096 **Young, Keith.** Relict lyellicerid fauna of Texas and northern Mexico [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 641, 1966.

3896 **Young, Leighton F., Jr.** Northeast Thompsonville field, south Texas—Key to future exploration for downdip Wilcox production: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 505–517, illus., 1966.

Sandstone in the Wilcox Formation from which gas is produced is believed to have formed as an offshore bar. A fault along the east side of the field may have originated as a slip surface on the seaward side of this bar. If offshore bars developed in an *en echelon* pattern as suggested by A. I. Levorsen, similarly formed hydrocarbon traps in the Wilcox Formation seem likely.—E.K.M.

4097 **Young, Robert G.** Differentiating shelf and marine sands from deltaic and brackish-water deposits using modern techniques [abs.]: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 3, pt. 1, p. 641, 1966.

4233 **Yungul, S. H.** Telluric sounding—A magnetotelluric method without magnetic measurements: Geophysics, v. 31, no. 1, p. 185–191, illus., 1966.

The theoretical basis and procedures of telluric sounding (TS) are discussed. Unlike magnetotelluric sounding (MTS), which requires simultaneous measurement of the y component of the magnetic field (magnetogram, difficult to measure with sufficient accuracy) and an arbitrary x component of the electrical field (tellurogram, simple to measure), TS uses two simultaneous tellurograms; one is recorded at a base station where the subsurface is known from a well log and the other at the field station where information is sought. These are Fourier analyzed. The primary objective of TS is sedimentary basins. It may be preferable to MTS in certain cases and vice versa; it is not meant to replace MTS.—D.B.V.

4333 **Zen, E-an; Hartshorn, Joseph H.** Geologic map of the Bashbish Falls quadrangle, Massachusetts, Connecticut, and New York: U.S. Geol. Survey Geol. Quad. Map GQ-507, scale 1:24,000, sections, separate text, 1966.

Metamorphosed lower Paleozoic sedimentary rocks underlying the Bashbish Falls quadrangle are: Stockbridge Formation (Cambrian and Ordovician), Walloomsac Formation and Egremont Phyllite (Ordovician), and Everett Formation (Cambrian or Ordovician). A chart shows correlation with adjacent areas. Metamorphic grade increases from northwest to southeast, at an angle to the nearly north-south structural trend. Typical mineral assemblages of the Everett Formation are given. The recumbent Foley fold extends the length of the quadrangle. Structure in the Taconic Range and the problem of the Taconic allochthon are discussed. Till, almost entirely derived from the local bedrock, covers most of the upland area west of the mountain front. Calcite and dolomite marble quarries in the quadrangle have been abandoned, but sand and gravel deposits are extensive.—M.C.M.

4307 **Zoltai, S. C.; Herrington, H. B.** Late glacial molluscan fauna north of Lake Superior, Ontario: Jour. Paleontology, v. 40, no. 2, p. 439–446, tables, 1966.

The fossil molluscan fauna found at 38 different localities is described. Its distribution establishes the extent of late glacial lakes north of Lake Superior. Ages range from 9,000 to about 5,000 years B.P.—R.E.G.

4318 **Zoltai, S. C.** Thunder Bay, surficial geology: Ontario Dept. Lands and Forests Map S265, scale 1:506,880, text, 1965.

In the Thunder Bay area ground moraine is the most widely distributed glacial deposit, forming a discontinuous mantle of till on bedrock. End and interlobate moraines consist of sand, gravel and boulders, and their thickness may reach 200 feet. Glaciofluvial deposits occur in elongated esker complexes and in kames and were flattened by subsequent wave action in some areas. Glaciolacustrine and lacustrine deposits are mainly varved or massive clays occurring in lowlands, in valleys, or as a mantle over low rock knobs. A discontinuous, thin layer of loess about two feet thick occurs in the western part of the area. During Wisconsin glaciation the area was covered by continental ice masses; three such masses were active in late-glacial times, and glacial lakes such as Agassiz, Kelvin, Nakina, and Ojibway were dammed in front of them.—M.C.M.

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